THURSDAY, AUGUST 19, 1915.

THE BOOK OF FRANCE.

The Book of France. In Aid of the French Parliamentary Committee's Fund for the Relief of the Invaded Departments. Edited by Winifred Stephens. Pp. xvi+272. (London: Macmillan and Co., Ltd.; Paris: E. Champion, 1915.) 5*s.* net.

THE catastrophe which has overtaken the world, and threatens to shake the very foundations of society, is destined to create a literature which has no parallel in history. This is inevitable, for—such is the irony of the situation—the nations that are engaged in this stupendous struggle are the most cultured and most civilised peoples on this earth, and to them the production and consumption of literary food is scarcely less necessary than the production and consumption of their daily bread. Appetite grows by what it feeds upon. Already the output of war books has reached a colossal proportion, and imagination boggles at the attempt to estimate the dimensions to which it will ultimately attain. Many of these books are, of course, ephemeral productions, created to satisfy a passing but no less insistent demand—books which are no books, as Charles Lamb would say—and in no true sense literature. But this can in no wise be said of the book before us. Although of no great magnitude or weight, and put together to serve an immediate and special purpose—to raise money, as Miss Winifred Stephens tells us, for French sufferers from German barbarity—it is of the very quintessence of literature—literature of the purest, most delicate, and most highly finished type. It is the joint production of some of the most distinguished literary craftsmen on both sides of the Channel—well-known English stylists translating the work of some of the most brilliant writers in the French world of letters—and it is adorned by the brush and pencil of eminent French artists. The work is therefore a timely and significant monument to that generous and lively amity which binds the two nations together in their joint resistance to the power of an evil domination, and we confidently share the hope—nay, we have the firm conviction—that the book will live and be prized as a memorial of an episode in the greatest struggle which has ever been fought for light and liberty against darkness and oppression.

Amidst so much that is excellent it seems invidious to make selections to illustrate the character of this remarkable production. The book opens with an appreciation of France by Mr. Henry James, written with the copiousness and *verve* which characterise all his work. It is followed by a short article by M. J. H. Rosny *aîné*, on British character and policy, translated by Mr. Thomas Hardy, in which, in a few pregnant paragraphs, our national excellences and shortcomings are dealt with in a manner as discriminating and tactful as it is just and true. An essay on the mentality of the Germans, by M. René Boylesve, translated by Dr. W. G. Hartog, is a keen and incisive psychological analysis of the Teutonic mind, written with detachment, and wholly dispassionate—an admirable example of the clear, penetrative insight of French criticism of the highest order. How true it all is Germany will yet come to realise in the awakening which is inevitably in store for her, no matter what the fortune of war may bring. Perhaps the most arresting and striking contribution to the work is the "Debout pour la Dernière Guerre!" by M. Anatole France, done into nervous, palpitating English by Mr. H. G. Wells. How true is all this!

"The prophetic nightmares of our scientific fantastics are being lamentably realised; they come about us monstrously alive, surpassing the horror of Dis, Malebolge, and all that the poet beheld in the Kingdom of Misery. But it is not Martians but German professors who accomplish these things. They have given this war a succession of forms that testify continually to their genius for grotesque evil, first the likeness of the waterspout and typhoon that brought them to the Marne and defeat irreparable, then the sullen warfare of the caverns, then the conflict of metals and chemicals. . . . A philosophical doctor, who sits beside me and reads as I write, interrupts: 'Be certain,' he says, 'that when they abandon that last method they will take to bacteriological war; after the poison gas and the jet of fire they will fight as disease cultures. We shall have to create in every country a Ministry of Anti-Teutonic Serums.' And to this their science has brought them! I recall the *mot* of our good Rabelais: 'Knowledge without conscience is damnation.'"

And how beautiful and how sublime is the invocation with which the whole ends!

"O Britain, Queen of the Seas and lover of justice; Russia, giant of the subtle and tender heart; beautiful Italy, whom my heart adores; Belgium, heroic martyr; proud Serbia; and France, dear Fatherland, and all you nations who still arm to aid us, throttle and end for ever this hydra, and to-morrow you will smile and clasp hands across Europe delivered."

The short essay by M. Remy de Gourmont, translated by Mr. Thomas Hardy, gives a vivid sketch of the condition of that fair land which has

been ravaged and defiled by the invader, and in its simple eloquence appeals irresistibly on behalf of those for whom relief is asked. "La Basilique-Fantôme," by Pierre Loti, translated by Sir Sidney Colvin, under the title of "The Ghost of a Cathedral," is a remarkable word-picture of the present state of the cathedral of Rheims, composed with that charm of expression and wealth of imagery which we have learned to associate with the work of its eminent author:—

"Oh, to think of the gross and dastardly and brainless brutality of hurling those canisters of scrap-iron in volleys against the fretwork, delicate as lace, which for centuries had reared itself proudly and confidently in air, and which so many battles, invasions, and whirlwinds had never dared to touch! . . . for all their shameless denials, it was the very heart of ancient France they were bent on here destroying. It was some superstitious idea which drove them to it, not merely their natural instinct as savages; and they worked fiercely at this particular piece of destruction. . . .

"The most irreparable disaster is that of those great stained windows composed by the mysterious artists of the thirteenth century in their devout dreams and meditations, and depicting men and women saints assembled by the hundred with their translucent draperies and luminous aureoles. There, again, the great bundles of German scrap-iron came stupidly volleying and crashing. Masterpieces that no one can reproduce showered down their fragments never to be sorted again, their wonderful golds and reds and blues, of which the secret has been lost, upon the pavement stones. Gone for ever those rainbow transparencies, gone for ever those companies of saints with the charm of their simple attitudes and pale, ecstatic little faces. Those innumerable precious cuttings of painted glass, which in the course of ages had acquired an iridescence like that of opals, lie strewn on the ground, and shattered as they are still gleam there like gems."

Madame Duclaux's "Les Coulisses d'une Grande Bataille," which she translates under the title of "The Background of a Victory," is a charming description, of mingled pathos and humour, of the events of September, as they presented themselves in the fields of the high-lying rolling plains that reach from the Marne to the Seine. She tells of the horror of the women of Melun at the sudden apparition of the Highlanders. "Ce sont maintenant les Allemands," they cried, as the squealing pipers tramped into the old market-square. She has something to say, too, of the imperturbable humour of Tommy and his invincible optimism. "'Are we getting the best of it?' she inquired of one. 'Is there much danger?' 'Well, miss,' said he, 'it's like this: the place is full up with Generals; and I don't know how it is, but I've always noticed where there's so many Generals there's not much danger!'"

She spoke to a douce, demure young Highlander, taking his Sunday afternoon's walk as quietly as if he had been in Glasgow: "How are things going? Do you think the Germans are coming?" "I've been hearing, Matam, that the Chermans will have been hafing a pit of a set-back," said he. And this was how Madame Duclaux first heard of the victory of the Marne.

Space will not permit us to dwell further upon this most interesting and most admirable work. It is in every respect creditable to all engaged in its production, and eminently worthy of the good cause which evoked it, and as such we commend it to all who sympathise with the stricken folk of the invaded Departments. Its price is well within the means of even the poorest of book-lovers, and in purchasing it they will have the satisfaction of knowing that they are not only contributing their mite towards the relief of those who sorely need it, but that they are acquiring possession of what they will come to treasure as a beautiful souvenir of a never-to-be-forgotten time.

T. E. THORPE.

ŒNOTHERA AND MUTATION.

The Mutation Factor in Evolution, with Particular Reference to Oenothera. (Macmillan's Science Monographs.) By Dr. R. R. Gates. Pp. xvi+353. 10s. net. (London: Macmillan and Co., Ltd., 1915.)

SINCE the publication of de Vries's classic work the Œnotheras have attracted more attention than almost any other plant or animal. So extensive a literature has already grown up about them that a critical guide to this great mass of papers would be cordially welcomed by every student of genetics. To some extent Dr. Gates has attempted the task, and if he has not been entirely successful this must be put down more to the immense difficulties of reducing the motley mass of facts to reasonable order, than to any lack of diligence and enthusiasm on the author's part. His book will certainly prove of service to those who wish to obtain some general idea of the problems offered by this famous genus, and have neither the leisure nor the inclination to wade through the thousands of pages, largely in foreign tongues, that have been written upon it.

The principal features of the genetic behaviour of the Œnotheras are brought out, and the author has included a chapter dealing with the cytological side with which he is probably more familiar than anybody else. The book is well

produced and amply illustrated, though the nature of the material is against some of the photographs being very illuminating.

In writing this book Dr. Gates evidently had a thesis which he was anxious to prove. He wishes to show that the various forms known as mutants, which are constantly thrown by many varieties of Œnothera, cannot be regarded as the outcome of any process of Mendelian segregation, but that they are due to some other process of germinal rearrangement which is termed mutation. Mendelian segregation, as is well known, is an orderly phenomenon enabling us to predict the gametic output of an individual formed by the fusion of two gametes of different genetic properties. We gather Dr. Gates's contention to be that, because in most cases it has not been found possible to predict the various Œnothera forms arising from a cross, the ordinary rules of segregation do not apply, and that these forms owe their origin to some process not yet understood.

The explanation of this process of mutation is considered by Dr. Gates to reside probably in abnormal divisions of the chromosomes following upon the loss of some hypothetical "condition of balance." He attempts to draw a sharp distinction between this process of mutation and what he terms the Mendelian hypothesis of mutation, by which the new form originates through the loss (or possibly also by the addition) of a definite factor or factors. His point of view is not easy to grasp, and perhaps may be best illustrated by some of his experiments. In a culture of *rubrinervis* some years ago there appeared a new type which he called *rubricalyx*. This form behaves as a simple dominant to *rubrinervis*, and we suppose that Dr. Gates would say that on the Mendelian hypothesis of mutation it arose through the addition of a factor R. When *rubricalyx* was crossed by *grandiflora* (pp. 254–9), a green-budded form, it gave an F_1 generation with red buds, though not so red as in *rubricalyx*. In ten different F_2 families the proportion of reds to greens varied greatly, being in one case as high as 33 : 1, and in another as low as 3 : 1. In a number of F_3 families similar ratios of reds and greens were obtained, while it was shown also that some reds bred true to red, and that green gave nothing but green. Further, there were several cases of an intermediate red breeding here. Dr. Gates argues that the different ratios of reds to greens and the fact of intermediates breeding true negative any Mendelian interpretation. Nevertheless the data as given present so many features in common with cases where a Mendelian interpretation has proved adequate that we feel little doubt that, had the analysis proceeded further, an interpretation in terms of a few factors would have been forthcoming, and we cannot but regret that this promising series of experiments should have been left in so indecisive a state.

Rigorous genetic analysis, working character by character, has yet to be applied to the Œnotheras. That it will prove more complicated than in most plants there is no question. The work already done shows that the Œnotheras, like some other plants, may present differences in the genetic properties of the male and female gametes produced by the same plant. They are also characterised by the high percentage of bad pollen grains, which may mean that some possible combinations are not formed. Indeed Renner has recently shown that in the ovules, too, there may occur an abortion of embryos corresponding to a given class of offspring (*cf.* Gates, p. 248). Differences in viability, as Dr. Gates points out (p. 89) may also characterise different forms. With all these possible sources of complication to be taken into account it is not surprising that the genetic behaviour of the Œnotheras is still in a state of chaos, and until proper methods of analysis have been applied and proved definitely to fail, it is surely premature to state that the ordinary rule of segregation does not occur in this genus.

In conclusion there are a few small alterations which we should like to find in another edition. "20" on line 3 of p. 23 should surely be "20 per cent.," and to call Drosophila a "pumice-fly" (p. 303) might lead to misapprehension as to the manner of its subsistence. We think also that in an English book the form Venice is to be preferred to Venedig (p. 248). A common error is perpetuated in the sentence on p. 320—"The new character is, at least in some cases, a dominant in crosses, which accounts for its spreading." The dominant, *qua* dominance, has, of course, no advantage over the recessive in a mixed population.

EVOLUTION THE OTHER WAY ABOUT.

Histoire de l'Involution Naturelle. By E. Marconi. Translated from the Italian by M. I. Mori-Dupont. Pp. xii + 505. (Paris: A. Maloine, 1915.) Price 15 francs.

THE evolution-theory aims at formulating the way in which the present-day state of things has come about. It is not demonstrable like the law of the conservation of energy; it is a way of looking at things—an interpretation. It reads the present as the natural outcome of the past. In this broad sense Dr. Enrico Marconi might be called an evolutionist, but he refuses the label,

having a special theory of his own. According to the generally accepted interpretation the great movement of the ages has been in the direction of increasing complexity and control (differentiation and integration), always allowing for some simplification in the case of parasites and other degenerates. But according to Dr. Marconi's interpretation the historic movement has been in the opposite direction. Mammals did not evolve from a Reptilian stock, but Reptiles from Mammals. Amphibians did not spring from a Piscine stock, but Fishes from Amphibians. The mistake that evolutionists have made in contemplating the stream of life is not a little one; they have actually mistaken the direction of the current! The author asks us to replace the evolution-idea by the involution-idea.

This arch-heresy has been suggested before, but it has never had, so far as we know, such an elaborate and beautifully printed presentation. The author is obviously sincere and in earnest, but he has not learned the humility of refraining from discussing questions, such as cell-division, which he has utterly failed to understand. What are we to say of this ingenuous and occasionally ingenious heretic?

There was a time long ago when our earth was too hot to offer hospitality to any living creatures of the sort we know about, and it is useless to speak of others. Therefore, so far as the earth is concerned, "matter" antedated "life." But it is open to anyone to defend the metaphysical thesis that in the world as a whole "life" is antecedent to "matter." We would not quarrel with Dr. Marconi over a luxury of this sort. But when we remember the fact that according to the rock record there were invertebrates before there were any vertebrates, and fishes before there were any amphibians, and reptiles before there were birds and mammals, and so on, we require arguments more cogent than Dr. Marconi's to persuade us to become "involutionists." And as to the development of the individual, while we agree with the author that the recapitulation doctrine requires careful handling, we do not think that the life-history of a frog, for instance, offers any suggestion whatsoever of the reptilian origin of amphibians.

We shall not discuss Dr. Marconi's detailed arguments that cyclostomes sprang from gnathostomes, and ascidians from amphioxus, and echinoderms from enteropneusts, and the branchial arch system of a dogfish from the thoracic skeleton of a mammal, for in truth what he says lacks zoological competence. It would have been profitable if Dr. Marconi had followed Dr. Dohrn and Sir Ray Lankester and restricted himself to illustrating the occasional occurrence of degenerative or involutionary changes in the history of animal life, but the author will have no half-measures. From an originally perfect manifestation of life man has fallen; and the ape and the tiger, the mole and the bat are his descendants!

When we read the words "involution naturelle" on the title-page we hoped that some light would be cast on Prof. Bateson's recent hard saying: "We may as well see whether we are limited to the old view that evolutionary progress is from the simple to the complex, and whether after all it is conceivable that the process was the other way about." But while Dr. Marconi is convinced that it has been the other way about, he starts from a super-man, and we do not suppose that this expresses Prof. Bateson's conception of primordial life. In one of Dostoievsky's novels it is quaintly remarked of one of the characters that he was the only man in the company who could move about on his head. We think that the author of this extraordinary, topsy-turvy interpretation of the world must be similarly unique.

ELECTRICITY FOR THE FARM.

Electricity for the Farm. By F. I. Anderson. Pp. xxiii + 265. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1915.) Price 5*s.* 6*d.* net.

THIS book is addressed particularly to American farmers who may not know how easy it is to make use of a stream of water in producing electric power and transmitting it for lighting and heating and mechanical purposes on a farm. It shows that the initial cost is usually small, that measurement of power is simple, that although the farmer must buy apparatus he can do this without employing an expert, and that he need have no difficulty in putting it up and getting it to work in such a way that it will give no trouble afterwards.

The author knows his farmer well, and his explanations are obviously such as will be understood. How to compute the power required for so many lamps in rooms and out-houses; for so many heaters of various kinds; for so many motors doing small or large domestic or farm work. How to measure the amount of water flowing in a stream, and knowing the fall to calculate the power of the stream. The farmer or his son, who will probably become an enthusiast, is supposed to have much common sense and a knowledge of simple arithmetic; he will certainly in time get a good working knowledge of electrical engineering. The author makes remarks which may cause a physicist to smile; for ex-

ample, "a falling body hits the ground with precisely the same force as is required to lift it to the height from which it falls." He evidently means that the work done in lifting the body is equal to the energy which it will expend in falling. His instructions as to the measurement of water by weirs are too inaccurate to please a water engineer, but they are really accurate enough for the farmer's purpose. His descriptions of turbines are too complex for the farmer and they do not show great knowledge of the subject, but the farmer does not need to understand them. The author is excellent in describing how to make a dam. His description of the dynamo is quite good and easy to follow, and it will certainly interest the farmer in electricity and cause the farmer's son to study the subject more fully, not merely through books, but through simple experiments. On practical matters—types of lamps, sizes of wire, wire joints, Ohm's law, wiring the house and premises, etc.—the author gives good simple instructions. The last quarter of the book is less important; it is intended for farmers who have no water power. It describes gas-engine plant and accumulators.

The American farmers have a respect for natural science and they are glad to cultivate new ideas. We think that the publication of this book will induce such men and their families to begin a fascinating study at small cost, with results in comfort and a widening of the mental horizon which ought to fill the town dweller with envy.

PRINCIPLES OF STOCK-BREEDING.

Breeding of Farm Animals. By Prof. M. W. Harper. Pp. xvii+335. (New York: Orange Judd Co.; London: Kegan Paul and Co., Ltd., 1914.) Price 1.50 dollars.

FEW callings have been more prolific in theories than stock-breeding. Many have been erroneous, while others which have borne a strong semblance of soundness have been inapplicable. Most of them have come from stock-breeders themselves; but others, which, as a rule, have received more attention, have come from outside observers. The great stock-breeders, more especially the great improvers, have given little heed to any other theory than that which has been tersely expressed in the words "put the best to the best," but others have been influenced by other theories, although their success in the production of good stock has usually been parallel with the strength of their adherence to the main theory whether that adherence was conscious or unconscious. After the introduction of printed herd and stud books, and therefore of "pure" breeding, the "pedigree" theory was generally taken to be a means of breeding good stock as well as "pure" stock, and only the very greatest stock-breeders stood fast by the "best to best" theory.

Like many a stock-breeder, Prof. Harper has lost sight of the main theory, and has allowed others to intervene. With him the Darwinian theory has effect as follows: "While the influence of climate and locality is great, and the factors at work are exceedingly complex, yet from a practical point of view we may consider the food supply and more favourable conditions generally, such as sufficient shelter, proper care, including training and developing, as the more important causes of variation." A paragraph is headed "Mendelism a Cause of Variation." And, after three chapters on Improvement due, 1, to "selection based on records of performance," 2, to "selection the result of prepotency," and, 3, to "accumulative development," it is stated "that the degree of development depends on the environment, including training, management, and the like." Apparently the weight of Bateson's "Materials for the Study of Variation," and Mendel's work has not yet been felt. It is no argument for the Darwinian view to say that "The thoroughbred horse has increased its speed by but eight per cent. in one half a century of racing. During this same period the standard-bred, *a comparatively new breed,* has reduced its trotting record by 27 per cent." The words in italics indicate some part of the argument to the contrary.

Parts of the work of Galton and Pearson are cited, but with no indication how the formulæ of these investigators, even if sound, are to be made use of by stock-breeders; and the idea that "the new individual inherits all the characters of the race to which it belongs," which is cited frequently and appears to be regarded as fundamental, is of very doubtful accuracy when applied to domestic animals. In the chapter headed "Mendel's Law of Heredity," the statements are made that "Mendel made a series of studies . . . from which he drew some general conclusions, now known as Mendel's law of heredity," and "Mendel's Law . . . depends on three factors—unit characters, dominance, and segregation." Apparently Prof. Harper has become acquainted with Mendel's Law from later writers rather than from Mendel himself.

In his volume, however, a source of information of very great importance is indicated. In the United States, careful records have been kept of the performances of the Holstein-Friesian breed of cattle, and these show that, as they had none, or one, or two parents in what is called the ad-

vanced registry, certain sires and dams had different chances of begetting progeny capable of entering the same registry. Surely if these records were closely examined and the failures counted as well as the successes, a more satisfactory theory might be promulgated as to the inheritance of milk and butter yield. The records of trotting horses have also been kept, and the belief is strong that some are the parents of performers while others are the grandparents only: the intervening generation being merely breeders of performers. Surely, again, the failures might be counted and some useful explanation of this phenomenon discovered.

JAMES WILSON.

OUR BOOKSHELF.

The Material Culture and Social Institutions of the Simpler Peoples: An Essay in Correlation. By L. T. Hobhouse, G. C. Wheeler, and M. Ginsberg. Pp. 299. (London: Chapman and Hall, Ltd., 1915.) Price 2*s.* 6*d.* net.

IT is difficult, and may be dangerous, to apply statistical methods to the sociology of uncivilised peoples. There are only a few monographs written on scientific lines; the greater part of the evidence consists in the incomplete and often prejudiced accounts of travellers. Results, therefore, over a wide field, must necessarily be rough, and, to attain even these, a very skilled judgment is required. But, for all that, even rough results of very careful work are valuable.

The authors of this study in correlation wisely choose material culture as the general characteristic of civilisation. By reference to this test, they have established "an advance in organised government accompanying economic development." Similarly, with the social order generally. The chapters dealing with these results are quite masterly, and the authors have the good habit of stating fully their difficulties, and the pros and cons, in the doubtful cases. In various ways it is shown that a purely pastoral society tends to become a "blind alley" of progress. Interesting results follow the discussion of marriage and the family, especially in the cases of polygamy and the "consideration" to the kin.

Full tables of all the data used are given, and there is a complete bibliography. The book is absolutely essential to the student of social evolution. It breaks fresh ground and consolidates new positions.

Agricultural Laboratory Manual: Soils. By Prof. E. S. Sell. Pp. iv+40. (Boston and London: Ginn and Co., 1915.) Price 1*s.* 6*d.*

THIS is a collection of forty exercises on soils. The book consists of forty sheets of scribbling paper held together by paper-fasteners inside a brown paper cover, so that each sheet may be used separately by the scholars and then bound up again with the rest. Each page has a few lines of printed directions at the top, followed in many cases by a ruled form in which the student is intended to enter his results.

The exercises are intended "for high schools, agricultural high schools, and normal schools." There is a list of apparatus required for the exercises, which includes such diverse articles as pie-tins, tomato-cans, compound microscopes, mill for pulverising soil (why not pestle and mortar?), and a compacting machine for soils, whatever that may be. The exercises themselves include the formation of soils as seen in a road or railway cutting; experiments on the separation of soil particles, their appearance and properties; the properties of sand, clay, and humus; the behaviour of water and air in the soil; cultivation, implements, fertilisers, and gardening. A teacher who lacked the knowledge or experience requisite for designing exercises himself might find some of the suggested exercises useful, but such a teacher would find himself in trouble with more than one of the exercises. No. 19, for instance, where the scholar is directed to find the percentage of air in the soil by putting a measured volume of soil in a beaker and pouring water on to it until the soil is just covered, would be likely to give very curious results. Again in exercise No. 27, a scholar who was accustomed to working with pie-dishes and tomato-tins would see all sorts of things except bacteria when "examining with a compound microscope a small sample of fertile soil placed on a slide in a few drops of water."

T. B. W.

The Evolution of the Potter's Art. By T. Sheppard. Pp. xx. (London: Brown and Sons, Ltd., n.d.)

THE pretentious title of this publication will disappoint the student in search of an adequate treatment of a difficult problem. Such a work would not be an easy task for even the most learned ethnographer, because it involves a knowledge of prehistoric and savage culture, acquaintance with the technique of work in clay, and a special familiarity with burial customs. It would be unfair to expect these qualifications in the hard-worked curator of a provincial museum. But it is sufficient to quote his comment on the discovery in pots from the so-called Danes' Graves near Driffield of the humeri of pigs: "so that we may assume that a shoulder of pork was food for the gods in the Early Iron Age." He must be aware that the joint was intended as food for the dead man's spirit. The book is really only an *edition de luxe* of one of the useful penny pamphlets which Mr. Sheppard has issued from time to time for the instruction of unlearned visitors to the museum at Hull. It is fortunate in possessing a good collection of early Staffordshire ware, with examples of the Worcester, Derby, Chelsea, Dresden, and other famous schools. From these materials the "Evolution of the Potter's Art" is worked out in six pages. The best point about the work is the series of sixty-two photographs of the more interesting specimens in the collection.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Colour Sensation.

IN NATURE of July 15 there is given an abstract of a paper by Dr. F. W. Edridge-Green in which he gives reasons for supposing that the sensation produced by spectral yellow is a simple sensation, and not a compound of red and green, as supposed by the Young-Helmholtz theory. In 1872 I read a paper on colour sensation before the Royal Scottish Society of Arts, in which practically all the experiments described by Dr. Edridge-Green are given, but the conclusion come to was that spectral yellow gave a compound sensation, because it could be altered by fatiguing the eye with either red or green. I have lately repeated these tests, and find my eyes still give the same reactions. To my eyes, the best yellow is just on the green side of the D lines in the spectrum, but if the eye is fatigued with red light the yellow is changed to greenish-yellow, and if fatigued with green it is changed to orange, that is, the yellow changes in colour towards the unfatigued sensation. Testing by means of a sodium flame gives the same result. In making this test, the flame should not be used immediately after lighting it, as it then contains, in addition to the bright yellow lines, a continuous spectrum. The test should be made when the flame is nearly burnt out and the salt crackling. In that condition only the yellow lines are visible, and it shows the change better than in its first condition. To the eye fatigued with red it has a distinct greenish hue, while to the other eye fatigued with green it is reddish. The change is quite marked, and there is no hesitation as to the conclusion.

With regard to the results given in the abstract of Dr. Edridge-Green's paper: (1) Fatiguing the eyes with pure yellow spectral light could hardly be expected to affect the hue of the red, and could only slightly diminish its brightness, which will be difficult to detect. (2) It is difficult or impossible to compare results when the eye in one case is flooded all over with a bright light, and the other in which it is fatigued with a narrow strip of weaker light which cannot be kept on the same part of the retina for any length of time. Results (3) and (4): Dr. Edridge-Green's eyes and mine do not give the same results as stated at the beginning of this letter.

It may be stated that the after-image seen on a white surface after looking at spectral yellow, and by the sodium flame, is the same as that given by a yellow compounded of red and green. Now if spectral yellow gave a simple sensation we would hardly expect this, as the after-image is a compound of all the unfatigued sensations, and we would expect spectral yellow if simple ought to give a nearly white after-image, and not a violet one.

There is an old saying that "Seeing's believing." In ordinary matters this may be so, but the belief is not necessarily true, and in questions of colour full of pitfalls. No two pairs of eyes see colours alike. This does not refer to colour-seeing and colour-blind eyes only, but there is reason to believe that all eyes differ more or less in their perception of colour, and questions of this kind can only be settled by the decision of many eyes, and their decision only applies to themselves.

JOHN AITKEN.

Ardenlea, Falkirk, August 10.

"The History of Upper Assam, Upper Burmah, and North-Eastern Frontier."

I HAVE had the opportunity of looking through this recent publication, which was reviewed in NATURE, vol. cxiv., p. 481, December 31, 1914. It is most interesting reading to anyone, but particularly to those like myself who spent many years on the Eastern Frontier among the tribes mentioned. This book covers so large an area, goes back so far into the past history of Assam since the East India Company were brought into relation with that country, and further back into a lost history of its ancient greatness, that 256 pages cannot do the subject justice. Very much which has been written of Assam, particularly in the Journal of the Asiatic Society of Bengal and other publications, is not referred to at all, while certain parts are very sketchy, even inaccurate. At the same time, very much that Colonel Shakespear has written is extremely interesting, and his knowledge and experience are very considerable, from having served so long in the country, and his conclusions sound. On p. 108, treating of events in the Dafla country in 1874, when Colonel Stafford commanded a force which entered the country, we find:—

"The Daflas made no resistance, but paid up fines and returned the captives. *Little or nothing was done by this large force in exploration or survey*, and it returned to Assam amidst a clamour from Government over wasted money" (the words in italics are mine. I would answer this statement by the following extracts from Reports, etc.).

I. The Indian Museum, 1814–1914. Calcutta, 1914. "Bhutan is still an unknown country to naturalists, and its territory represents the most important gap in our geographical knowledge of the Himalayan fauna. East of Bhutan two expeditions of very different date are of zoological importance, namely, the Dafla expedition of 1874–75 and the Abor expedition of 1911–12. On the first of these, Godwin-Austen, then a Major in the Bengal Staff Corps attached to the Survey of India, himself made collections of great value, and also encouraged his subordinate officers to do the like."

II. As to the survey work. In a Memoir on the Indian Surveys, by Clements R. Markham, C.B., F.R.S. India Office Publication. 1878, p. 173.

"In 1875 Major Godwin-Austen accompanied the Duffla military expedition against the tribes on the northern frontier of Assam. Narainpur, on the Dikrung Nullah, was reached on December 2, 1874, and from a base on the banks of the Bramaputra a short series of triangles was extended northward into the Duffla hills. Owing to the brief period during which the military were in the country, the survey party were unable to remain beyond two and a half months. The out-turn of work amounted to 1705 square miles of entirely new topography, on the scales of two and four of the season's work in the Duffla hills, has been compiled by Major Godwin-Austen, and is a valuable addition to our geographical knowledge of the region beyond the northern frontier of Assam. Lieut. Harman, R.E., rendered assistance by surveying the course of the Ranga river; and Mr. Lister, of the Royal Botanical Gardens, Calcutta, was assiduous in making a collection of plants, seeds,

and dried botanical specimens. The Surveyor-General expresses a hope that these explorations on the Northern Assam frontier will be continued, and is of opinion that with tact and precaution all difficulties in the way of visiting and exploring the narrow strip of hills between the Assam valley and Tibet may be overcome."

As to the natural history work, there was published:—

III. Journal Asiatic Society of Bengal, vol. xliv., part ii., 1875: Notes on the Geology of part of the Dafla Hills, Assam; lately visited by the Force under Brigadier-General Stafford, C.B., by Major H. H. Godwin-Austen, F.R.G.S., F.Z.S., etc., Deputy Superintendent Topographical Survey of India, with map. Plate ix.

IV. Journal Asiatic Society of Bengal, vol. xlv., part ii., 1876: On the Helicidæ collected during the Expedition into the Dafla Hills, Assam, with plate viii., p. 311.

V. On the Cyclostomacea of the Dafla Hills, Assam, p. 171, with plates vii. and viii. *a*.

VI. List of the Birds collected on the Expedition into the Dafla Hills, Assam, together with those obtained in the adjacent Darrang Terai, with plates iii. and iv., p. 64, by same author.

H. H. GODWIN-AUSTEN.

Moustier Implements and Human Bones in Suffolk.

OWING to the liberality of the trustees of the Percy Sladen Memorial Fund, I have been enabled during the past eighteen months to conduct a continuous series of excavations in the south-west corner of Messrs. Bolton and Laughlin's brickfield, Ipswich, where a well-marked "occupation-level" occurs resting upon a weathered surface of chalky boulder clay, and covered by a very hard and compact sandy loam of a greyish colour. It appears that since the people lived who occupied this "floor" the valley, which is now dry, has been deepened considerably, and as the "floor" passes into a small escarpment to the south at a depth of about 10 to 12 ft. from the surface of the ground, it seems that a considerable antiquity must be assigned to the human relics associated with it. The occupation-level under investigation is very rich in flint implements, which, in my opinion, must be assigned to the Moustier epoch. (Traces of another occupation-level occur above the Moustier deposit, containing implements of a totally different type which approximate to the earlier Aurignac examples.) With the flints have been found several hundreds of animal bones, representing chiefly the remains of the horse, and one specimen referable to the mammoth. Numerous fragments of very rough and primitive pottery occur in the floor, and tend to support Dr. Rutot's claim that about five hundred fragments of pottery were found at Caillou-qui-Bique, associated with an upper Le Moustier industry. Three portions of the human skeleton have been found scattered upon the "floor" with the flints and mammalian bones. These comprise a small portion of the upper margin of the occipital bone of a skull 10 mm. in thickness, the shaft of the left humerus of a woman, and the shaft of the right femur of a man. There seems little doubt that any of the bones found belonged to individuals of the Neanderthal race. All the human and animal bones are well preserved and in a condition of fossilisation. The excavations are still in progress, and it is hoped that further discoveries will be made.

J. REID MOIR.

12 St. Edmund's Road, Ipswich, August 13.

THE GAS INDUSTRY AND EXPLOSIVES.

THE need that has arisen for certain coal-tar products for the manufacture by nitration of the high explosives essential in the present war, has riveted attention on the best methods for obtaining these, and of keeping up the supply to the highest possible amount during the period of hostilities.

The substances most needed are the aromatic hydrocarbons, of which benzene forms the base from which the newest and most powerful of these explosives, tetranitroaniline, is prepared, and also the tetranitromethylaniline, which under the name of "tetryl" is playing an important part in detonators and primers. Toluene, the next member of the aromatic group, is needed in enormous quantities to nitrate to trinitrotoluene, or T.N.T., whilst carbolic acid is the base from which picric acid is formed, this body under slightly varying conditions being the English explosive lyddite, the French melinite, and the Japanese shimose powder.

The aromatic hydrocarbons found in the coal-tar are only a small proportion of those existing in the gas, as the volatility of the so-called benzols—benzene, toluene, and xylene—causes the largest proportion of them to be carried forward as vapour in the coal gas, and on cooling this gas and scrubbing it with creosote oil a much larger yield is obtained from the gas than from the tar.

The formation of these bodies is due to the action of heat on the primary constituents of the decomposition of the coal, and when coal is distilled at very low temperatures the primary products of the decomposition, which largely partake of the character of paraffins, *i.e.*, saturated hydrocarbons, are found, whilst the aromatic hydrocarbons are to all intents and purposes absent. As the temperature of carbonisation is raised, the paraffin hydrocarbons become less in quantity, and naphthenes make their appearance in the tar. At still higher temperatures, these naphthenes split off hydrogen and become converted into aromatic hydrocarbons, such naphthenes as hexahydrobenzene being converted into benzene with evolution of hydrogen. As the temperature of carbonisation is still further increased, the tendency is for these bodies to become converted into naphthalene, whilst the employment of very high temperatures with light charges gives rise to a tar which contains only very small traces of aromatic hydrocarbons, large quantities of naphthalene, and a very large proportion of free carbon, produced by the degradation by heat of the other hydrocarbons present.

When, however, vertical retorts and heavy charges with horizontal retorts were introduced, a marked improvement in the quality of the tar took place: the heat from the walls of the retort passing slowly into the mass of coal distilled off the tar vapours at the lowest possible temperature, and these, finding an exit through the comparatively cool core of the coal to the mouthpiece, a large proportion of the lowest temperature tar was produced. As the charge became more and

more thoroughly carbonised, the central core became blocked with pitch and tar distilled forward into the coal mass, and the gas and tar vapour being in this latter stage forced to find their way through the outer shell of red-hot coke, became degraded to the utmost limit, and gave very large volumes of such permanent gases as hydrogen mingled with methane, the least easily broken up of the hydrocarbons, the result being that the modern tar is in reality a mixture of low temperature and very high temperature tar. Such a tar, obtained from a good gas coal, will contain approximately :—

Benzol	0·60 per cent.
Toluene	0·15 ,,
Solvent naphtha	1·00 ,,
Heavy naphtha	1·65 ,,
Carbolic acid	0·6 ,,
Cresylic acid	0·9 ,,
Creosote oil	30·6 ,,

The remainder is naphthalene, anthracene, and pitch.

If the gas from the carbonisation be scrubbed, and the absorbed hydrocarbons be distilled out from the creosote oil and added to the light hydrocarbons obtained from the tar, the total yield is :—

Benzol	2·1 per cent.
Toluene	2·1 ,,
Solvent naphtha	2·6 ,,
Heavy naphtha	2·6 ,,

It is found in practice that the carbonisation under the ordinary gasworks conditions of a ton of good bituminous coal yields about one-third of a gallon of toluene from tar and gas.

In practice, the withdrawal from the gas of all the hydrocarbons that can be scrubbed out by creosote oil would reduce the heating value of the gas to a considerable extent, and various methods of getting over this trouble have been proposed, such as enriching the scrubbed gas by the benzene and xylene from the crude benzol after separation of the toluene by fractional distillation, or by so scrubbing the original gas that only about one-third of the crude benzol is withdrawn, as by such means the calorific value of the gas can be maintained at or above the statutory minimum of 500 British thermal units.

The tar and gas made in small country works as a rule contain more aromatic hydrocarbons than the products from large works, as the temperatures used in carbonisation are not so high; and should the Government need still larger quantities of toluene and carbolic acid for nitration, the gasworks of the Empire could treble the output by reverting to the temperature and methods employed before the introduction of regeneration in the furnaces. This, however, would reduce the gas yield from the 13,000 cubic feet per ton now aimed at by the gas manager to 10,000 cubic feet, but the higher calorific value of the gas would allow of the volume being made up by the addition of blue water gas.

THE ELECTRONIC THEORIES OF THE PROPERTIES OF METALS.

IN a course of lectures delivered at the Cavendish Laboratory during the Michaelmas term of 1886, Sir J. J. Thomson examined the dynamical result of assuming the passage of electricity through a metal to be of the same nature as through an electrolyte. The subject was dealt with more completely in "Applications of Dynamics to Physics and Chemistry" in 1888. The later discovery of the electron which might act as a carrier of electricity from molecule to molecule placed the idea on a much firmer footing, and in 1898 Riecke developed theories of the electrical and thermal conduction and thermo-electrical properties of metals, based on the existence between the molecules of carriers of positive and negative electricity. Two years later Drude worked out more systematically theories founded on the same basis, and it is his work which is usually quoted in accounts of electronic theories, generally with the simplification that only one type of carrier—the negative electron—is taken as moving freely between the molecules. These electrons are supposed to be produced by the dissociation of the electrically neutral metal atoms, what remains of the atom being left positively charged.

The moving electrons are assumed to have the same average kinetic energy as a molecule of a gas enclosed in a cavity in the metal would have. The nature of the impact of electron on metal atoms is not discussed, but as the motion of each metal atom is likely to be comparatively small, the gas laws which hold for the motions of the molecules of a light gas amongst those of a much heavier are applied and the electrons are said to have a mean free path of length λ. The motions are distributed in all directions equally, and the electrons cannot escape through the surface of the metal unless their speed perpendicular to the surface exceeds a certain limit. The action of ultra-violet light on the surface facilitates the emission.

When an electromotive force is applied to the metal there is superposed on this to and fro motion of the electrons a drift up the electric field, the relation of which to the field is such that the specific conductivity of the metal is proportional to $n\lambda/\sqrt{T}$ where n is the number of free electrons per cubic centimetre and T is the absolute temperature of the metal. Since the electrical conductivity of a pure metal is known to vary approximately inversely as the absolute temperature, this implies that $n\lambda$ must vary inversely as $\sqrt{T}$. As there is nothing on the one hand to suggest so considerable a change of the free space between the metal atoms with temperature, while on the other the facts of thermoelectricity are against any considerable decrease in the number of electrons per c.c. as the temperature rises, it sems difficult to reconcile the law of variation of $n\lambda$ with experimental facts.

If a slope of temperature exists in a metal, the

electrons coming from the hotter side of a cavity between two metal atoms will move more rapidly than when coming from the colder. There will therefore be a drift of energy towards the colder metal which bears to the slope of temperature such a relation that the heat conductivity of the metal is proportional to $n\lambda\sqrt{T}$. As the heat conductivity of a pure metal changes very little with change of temperature, this equation again implies that $n\lambda$ varies inversely as $\sqrt{T}$, and we have the same difficulty in understanding how this is brought about. On dividing the heat conductivity by T times the electrical conductivity the product $n\lambda$ disappears from the result, and we obtain a constant the value of which should be approximately $2{\cdot}3\times10^8$ for all metals at all temperatures. At air temperatures the values found experimentally vary between 2 and 3×10^8, and at very low temperatures between $1{\cdot}5$ and 3×10^8. The agreement between the two results is undoubtedly good, but when the calculations are improved in accuracy by taking into account the variation of the speeds of the electrons about the mean value used by Drude, Lorentz finds the constant $1{\cdot}5\times10^8$, which is not in such close agreement with experiment. For alloys and conducting salts the experimental values are considerably higher than for pure metals, and Koenigsberger and others have put this down to the part played by the atoms themselves in the conduction of heat. For quartz and other electrical insulators which are good conductors of heat there can be no question of the insignificance of the *rôle* of the free electrons.

Owing to the different values of the concentration n of electrons in different metals, there will be a flow of electrons through the surface of contact of two metals till the potential difference produced stops the flow. In an unequally heated metal the same process of compensation will occur. In the former case we get the Peltier and in the latter the Kelvin effect. The former agrees in order of magnitude with the values found by experiment, but as Sir J. J. Thomson has pointed out, it is difficult to reconcile the great decrease of electrical conductivity of a metal on melting with the small Peltier effect between solid and molten metal. The calculated Kelvin effect shows that the concentration n of the electrons must in all metals be nearly proportional to $\sqrt{T}$, a result which is not easily reconciled with that for $n\lambda$ deduced from the electrical or thermal conductivity.

Since a negative electron in motion in a magnetic field is acted on by a force transverse to its path, the theory affords a simple explanation of the Hall effect, and gives the right sign and order of magnitude for the effect in bismuth at ordinary temperatures, but the wrong sign for the effect at low temperatures, and for the effects at ordinary temperatures in iron and antimony.

In no field can the simple electron theory be said to have given a satisfactory quantitative account of the facts, and its elaboration in one region has in general led to greater difficulties in others. The kinetic energy of the electrons it postulates is so great that an increase of 1° C. in their mean temperature involves a supply of heat ten times the specific heat of the metal. After pointing this out Sir J. J. Thomson, in 1907, in his "Corpuscular Theory of Matter," developed a new theory which may be called the doublet theory. According to this theory the atoms of a metal are grouped together in pairs, one of each pair positively, the other negatively charged. In ordinary circumstances the axes of these doublets point in all directions on the average equally. Under the action of an electric field the doublets tend to arrange themselves in lines, with the positive end of one near the negative of the next, and electrons may pass from the negative end of one doublet to the positive of the next, and so along the line of doublets.

On the assumption that the axis of the doublets distribute themselves according to the gas law, that their centres are spaced on the average b apart while the charges of the same doublet are d apart, and p electrons are discharged from a doublet per second; the electrical conductivity of the medium works out proportional to $nbdp/T$ where n is the number of doublets per c.c. and T the absolute temperature. The experimental facts show that $nbdp$ is independent of temperature. In the same way the transport of kinetic energy by an electron leaving a doublet at a higher, and joining one at a lower temperature, leads to a heat conductivity proportional to nb^2p, which the experimental facts show is independent of temperature. The quotient of the heat conductivity by T times the electrical conductivity on this theory comes $2{\cdot}6b/d\times10^8$, and as b/d must be greater than unity the agreement with the experimental value 2 to 3×10^8, is about as good as in the case of the simple theory. The presence of the b/d makes it possible to include in the theory those substances for which the quotient is high.

At the junction of two metals the excess flow from one metal will cause a difference of potential and an electric field which will change the orientation of the doublets until the flows are equalised. In an unequally heated metal the same method of compensation will come into play, and we have the Peltier and Kelvin effects.

If the rotation of a doublet in an electric field does not take place about the middle point, the two charges of the doublet move with different speeds. If they are in a magnetic field its action on them will tend to incline the axis of the doublet to the plane containing the two fields, and there will be a flow of electrons at right angles to both fields. The direction of the flow will be determined by that of the end of the doublet which moves most quickly. We thus have an explanation of the Hall effect, whether it be positive or negative.

No numerical comparisons of theory with experiment appear to have been made in the case of these thermo-electric and thermo-magnetic effects.

In his addresses to the Institute of Metals on May 5, and to the Physical Society on June 25, Sir J. J. Thomson dealt with the modification of

his theory necessary to bring it into line with the discovery by Prof. Kamerlingh Onnes that at very low temperatures—4° or 5° absolute—the electrical conductivities of metals become infinite. The external electric field applied to the metal is assisted in bringing the axes of the doublets into line by the field produced by those doublets already in line. The kinetic energy of thermal motion of the doublets tends to destroy the alignment. At ordinary temperatures it is sufficient to destroy the alignment so soon as the external field is withdrawn, and the flow of electrons from doublet to doublet is stopped. But at very low temperatures the energy is not sufficient to modify an alignment once produced, and the flow of electrons continues when the external field is withdrawn. The conductivity in these circumstances will be very high.

From this short account of the present position of the two theories it will be seen that the doublet theory of Sir J. J. Thomson has shown a greater power than the electron theory of co-ordinating the facts of experiment. It has difficulties of its own, both in the nature of its fundamental assumptions and in its power of reproducing the facts quantitatively. It does not appear to provide electrons for emission by incandescent bodies, and in its latest development it involves serious changes not previously suspected in the thermal, thermomagnetic, and thermogalvanic properties of metals at the very low temperatures attained by Prof. Kamerlingh Onnes. But the great flexibility it has shown justifies a more generous treatment of it by those authors and lecturers who have been content to limit their exposition of these questions to the older electron theory.

C. H. LEES.

THE STERILISATION OF WATER.

THE safeguarding of our water supplies is of particular importance at the present time, for there may be considerable risk of pollution if typhoid and cholera cases or "carriers" arrive in any number from the seats of war, as may well be the case. The research work carried out by Dr. Houston is therefore of much value and is summarised in a Report just issued.[1]

Dr. Houston first deals with his "excess lime" method of purification. The hardness of water is chiefly due to bicarbonate of lime (temporary) and sulphate of lime (permanent), the former being kept in solution by the carbonic acid present. In the softening of water lime is added and combines with the free and semi-combined carbonic acid, causing a precipitation of the lime added and of the bicarbonate of lime in the water in the form of the relatively insoluble carbonate of lime. A water treated with the right amount of lime has no caustic alkalinity and has practically no action on the bacteria present. When more than enough lime is added the water is rendered caustically alkaline and becomes actively bactericidal. Such a water would, however, be unfit for domestic and trade use, but if the excess of lime present be removed by the addition of a sufficiency of water from which the bacteria have been removed, the whole of the mixed water will be softened and purified, and will be satisfactory for all purposes. Dr. Houston has previously shown that if raw river water be stored for from four to five weeks the great majority of the bacteria are removed, and the water is rendered safe for drinking purposes.

The excess lime method of purification consists, then, in the addition of an excess of lime, storage of the alkaline water for a day or thereabouts, so that the bactericidal action may be exerted, addition of a sufficiency of water, purified by storage, to neutralise the excessive alkalinity, and filtration to remove the precipitated carbonate of lime.

Dr. Houston has tested the method on a large scale at Sunbury and at Aberdeen. At Aberdeen *Bacillus coli* (which may be taken as an index of pollution) was present in the untreated water in from 1 c.c. to 100 c.c.; after treatment it was not found in 100 c.c.; the process is therefore efficient and it is comparatively inexpensive.

Another research which has been carried out by Dr. Houston is an investigation of "water microbes" giving the cholera-red reaction after incubation of cultures for twenty-four hours. The cholera-red reaction (obtained by adding acid to a culture) is a very constant and characteristic reaction of the cholera microbe, and as this organism is frequently conveyed by water, it is important to know whether water organisms other than cholera yield the reaction. It is satisfactory to find that, although eighty microbes out of approximately 1885 sub-cultures gave the cholera-red reaction on first being tested, they were easily distinguished from cholera by the application of two or three further simple tests.

Dr. Houston is to be congratulated on the valuable research work he has been able to carry out in the midst of a vast amount of routine work.

R. T. HEWLETT.

[1] Metropolitan Water Board. Eleventh Report on Research Work, together with Index to Research Reports, Nos. i–x inclusive. By Dr. A. C. Houston. Pp. vii+52. (London: Metropolitan Water Board, n.d.) Price 2s. 6d.

THE LATE PROF. J. COOK WILSON.

DEATH has of late been busy among Oxford residents. The demise of John Cook Wilson, Wykeham Professor of Logic, was not unexpected, for he had been in bad health for more than a year, and indeed had never recovered completely from the shock of his wife's death in January, 1914. Cook Wilson was a man of quite exceptional attainments. Born at Nottingham and educated at Derby School, he matriculated at Oxford in 1868. As scholar of Balliol he took no fewer than four first classes, two being for mathematics and two for classics. These were followed by the Latin Essay, the Conington Prize, and a fellowship at Oriel. After his election as Wykeham Professor he became a fellow of New College, but his affection for Oriel never waned, and his connection with his old college was of late

years renewed by an honorary fellowship. His lectures and less formal courses of instruction were keenly appreciated, and his influence on the philosophical and logical studies of Oxford was very great. His published works, though giving evidence of much learning and critical acumen, were not copious in relation to the width and depth of his erudition. Cook Wilson was a man of strong views. These he was always ready to maintain with an eagerness and occasional vehemence which amused, but never offended, his interlocutors. His controversy with Archer Hinde over the *Timaeus* of Plato gave occasion for a display of fighting qualities which is still remembered in Oxford with sympathetic appreciation. He was not only a finished classical scholar, but also an accomplished mathematician; and to these attainments he added an unusually complete knowledge of German language, literature, and philosophy. One of the subjects to which he had devoted attention was the difficult problem of Greek music. On this he held views which did not coincide with those of many of the recognised authorities, in particular of the late Provost of Oriel, D. B. Monro. It must be confessed that he had his foibles; among them a somewhat deficient sense of proportion, especially in respect of time. But these in no way interfered with the regard in which he was held for the sterling worth and simplicity of his character. "The Cooker," as he was affectionately styled by his pupils and many of his colleagues, was an enthusiastic volunteer. He did much to keep alive the interest in military matters which in the days before the Boer war showed signs in Oxford, as elsewhere, of a dangerous slackening. He was practically the creator of the cyclist contingent of the O.U.V., and his manual of training for that body became a model for the cyclist service throughout the army. Many will remember "Das Kochmannslied," a piece of good-natured banter by H. W. Greene, of Magdalen, in which humorous reference was made to Wilson's military prowess, his famous manœuvre for the discomfiture of hostile cavalry, his "gyrotwistive Knasterbart," and his polemic with Archer Hinde. "Multis ille bonis flebilis occidit."

NOTES.

We are officially informed that Prof. H. B. Baker will be unavoidably prevented from attending the Manchester meeting of the British Association, and that, in his place, Prof. W. A. Bone will be the president of the Chemistry Section.

The following additional information has reached us with reference to the communications which may be expected to be made to Section B of the forthcoming meeting of the British Association:—Prof. P. Henry (Louvain), vinyl acetic nitrite; Dr. A. Hynd, configuration in the sugar group; Dr. Sand, a new cadmium vapour arc lamp; Dr. W. E. S. Turner, ionisation in solvents of low dielectric constant; Dr. Turner and Mr. Cauwood, molecular state of salts in solution; papers on flame and combustion, with experimental illustrations, probable contributors, Prof. Dixon, Dr. Wheeler, and Dr. Coward.

A munitions inventions branch of the Ministry has been constituted, with Mr. E. W. Moir as comptroller. The branch, which for the present is located in Armament Buildings, Whitehall Place, will have the duty of considering projects for inventions relating to munitions for warfare on land or matters appertaining thereto. The comptroller and staff of the branch will be assisted in their work of examination, and, if thought necessary, in the investigation and development of any projects that may be considered worthy of being developed, by a panel of honorary scientific and other experts. The following have accepted Mr. Lloyd George's invitation to act on this panel:—Col. Goold Adams, Mr. Horace Darwin, Mr. M. Duckham, Mr. W. Duddell, Dr. S. Z. de Ferranti, Dr. R. T. Glazebrook, Sir R. Hadfield, Dr. J. S. Haldane, Col. N. B. Heffernan, Sir A. Kennedy, Mr. F. W. Lanchester, Dr. A. P. Laurie, Prof. Vivian B. Lewes, Mr. M. Longridge, Mr. W. H. Maw, Sir Hiram Maxim, Capt. Moore, Sir H. Norman, Mr. F. G. Ogilvie, Major-Gen. G. K. Scott-Moncrieff, Mr. W. Stokes, Mr. J. Swinburne, Sir J. J. Thomson, Mr. A. J. Walter, Mr. C. J. Wilson. All communications should be addressed to the Comptroller at the address given above.

The President of the Board of Agriculture and Fisheries has appointed a committee (consisting of Lord Middleton (chairman), Mr. Henry Chaplin, Sir Ailwyn Fellowes, the Hon. Alexander Parker, Major Sir M. Burrell, Bart., Sir G. Greenall, Bart., and Capt. M. S. Adye) to consider and advise the Board as to the steps which should be taken to secure the production and maintenance in England and Wales of a supply of horses suitable and sufficient for military purposes, especially on mobilisation. Mr. E. B. Wilson, of the Board of Agriculture and Fisheries, has been appointed secretary of the committee.

It is reported from Stockholm that the Nobel prizes for the present year will amount to 8100*l.*, but that the distribution may be postponed. From next year the prizes will be reduced by 1125*l.*, representing the amount of the new Swedish defence tax.

The sum of 140*l.* has been given to the Royal Society of Arts by Mr. R. Le Neve Foster for the purpose of founding a prize in commemoration of his father, Mr. Peter Le Neve Foster, who was secretary of the society from 1853 to 1879. The council has decided to offer the prize (consisting of 10*l.* and the society's silver medal) for a paper on "Zinc: its production and industrial applications." Competing papers (which must be typewritten) must reach the secretary of the Royal Society of Arts by, at latest, December 31, 1915.

According to a Reuter telegram the Vienna Academy of Sciences has made a grant of 160*l.* to Prof. R. Poech to enable him to conduct anthropological researches among the various races comprising the Russian prisoners of war.

We learn from *Science* that Prof. W. H. Welch, of the Johns Hopkins University, and Dr. S. Flexner, of the Rockefeller Institute for Medical Research, are

about to inspect and report upon the medical schools and hospitals of China, on behalf of the China Medical Board of the Rockefeller Foundation.

WE see from *Science* that an expedition has been sent by the St. Louis University to study tropical diseases and biology in British and Spanish Honduras. The expedition consists of Dr. J. P. Coony, professor of chemistry; Dr. E. N. Tobey, instructor in tropical diseases; and A. M. Schwitalla, a student in biology.

WE regret to announce the death of Mr. Robert Hammond, a short account of whose career is given in *Engineering* for August 13. Mr. Hammond was one of the pioneers of electric lighting in this country, and was the first concessionaire of the Anglo-American Brush Electric Light Corporation, Ltd. He was also associated with Messrs. Greenwood and Batley in the manufacture of electric machines, and put down the first works in this country in which current was distributed from a centre for lighting at high tension by incandescent lamps. Mr. Hammond put down electrical supply works in a great number of towns in this country and abroad. He was an ardent exponent of municipal trading; his services were often requisitioned as an expert witness. By reason of his kindly disposition and genial manner he established friendly relations with all with whom he came in contact, and his loss will be widely felt and deplored by his host of friends in all parts of the country. He contributed many papers for technical societies; in 1902 he succeeded the late Prof. Ayrton in the capacity of honorary treasurer of the Institution of Electrical Engineers, a position which he held until the time of his death. He was also a member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers.

THE death of Mr. Edwin Charles Carnt is announced in *Engineering* for August 13. Mr. Carnt took up active work in the firm of the late Mr. John S. White at Cowes in 1898, a time contemporaneous with the almost world-wide recognition of the immense potentialities of torpedo craft. His experience as an officer in the Navy, as a member of the engineering staff of the dockyards, and as an overseer in private works, together with his personal qualifications, marked him out as an appropriate engineering manager of such works as White's. The firm, under his dominating energy and wide practical experience, quickly stepped into and retained a high place among the constructors of high-speed light craft of all types. His death took place on the 5th inst.

WE regret to have to record the death, on August 16, at the age of seventy-seven years, of Mr. F. Victor Dickins, C.B., who was registrar of the University of London from 1896 to 1901.

PARTICULARS are given in the *Morning Post* of Monday last concerning Capt. E. Bage, of the Australian Engineers, who was killed in action at Kaba Tepe some weeks ago. In 1911 he joined Sir Douglas Mawson's Australasian Antarctic Expedition, making a record of tidal observations at Adelie Land. In the summer of 1912–13 Capt. Bage led his two comrades —F. H. Hurley (now serving with Sir Ernest Shackleton) and E. N. Webb (magnetician)—within fifty miles of the south magnetic pole. On the journey back to winter quarters they failed to find a food depôt, but got back to safety after nine weeks of great hardship. During the second year of enforced wintering Capt. Bage turned his attention to magnetic work and astronomy, and made further valuable additions to Antarctic science.

A REUTER message from Zurich states that the Laryngologists' Society has expunged the name of Sir Felix Semon from the list of its honorary members, the reason given being that, although Sir Felix was born in Germany, and studied in Vienna and Berlin, he wrote a letter to the *Times* expressing detestation of the barbaric methods of the Germans in the war.

THE summer meeting of the Royal Cornwall Polytechnic Society will be held at Falmouth on August 31 and September 1 and 2, when the following communications will be made:—On August 31, "The Physical Condition of Cassiterite in Cornish Mill Products," by the late J. J. Beringer, further explained by W. H. Trewartha-James; on September 1, "The Occurrence of Tin and Tungsten in the West of England," by J. H. Collins; "Development of Mechanical Methods in China Clay Mines," by J. M. Coon; and "Prospects for Tin in the United States," by H. F. Bain. On September 2 a paper on "Piskies: a Folklore Study," will be read by H. Jenner, and a lecture on "The Fly Problem," delivered by F. Balfour Browne. A feature of the meeting will be a display of exhibits illustrating British articles of commerce previously either wholly or partly supplied by Germany and Austria.

THE provincial sessional meeting of the Royal Sanitary Institute will be held at Brighton on September 3 and 4, when discussions will take place on Indian sanitation, camp sanitation, maternity and child welfare, and on the final report of the Royal Commission on Sewage Disposal.

WHEN the Institution of Electrical Engineers has been able to arrange the various historical specimens of apparatus which it has collected for its museum, it will possess one of the most interesting collections of this character. The latest addition has been made by H.M. Queen Alexandra, who has given the institution a pair of Bell telephones presented to her in 1878, and made on board H.M.S. *Thunderer*. These instruments were actually used for conversation between the schoolroom and her Majesty's sitting-room at Marlborough House for a number of years. The Institution of Electrical Engineers is situated on Victoria Embankment, and it is therefore quite appropriate that it should possess the original Gramme dynamo used for the first experimental lighting of the Thames Embankment. There is also in the collection one of the Jablochkoff candles used in those days, and we believe that, to make this part of the collection complete, one of the holders employed for these

would be welcome. One of the most recent additions is a Holmes magneto-electric generator, which has worked the lamps at the Sowter Point lighthouse continuously since 1870 until only two or three years ago, and the Gramme dynamo which lighted the *Daily Telegraph* offices in 1882 is also in the possession of the institution. Another relic, but of more recent historic interest, is the set of telephones employed on the Scott Antarctic Expedition.

THE Board of Education has issued a circular stating that an urgent request has been received for books for the use of the British civilian prisoners at present interned in the concentration camp formed on the racecourse at Ruthleben, Germany. The books are needed by the educational classes in connection with the Camp Education Department, which has recently been formed for the benefit of the prisoners in question. The Board of Education has sanctioned the issue of an appeal for books of the kind specified in the circular above referred to. As the number of books which can be sent to Ruthleben is limited, it will be well for intending donors to apply for a copy of the circular (which gives the titles of the works needed) to Mr. Alfred T. Davies, Board of Education, Whitehall, S.W., writing in the left-hand corner of the envelope "Books for Ruthleben." We may mention that lectures have been delivered by the Arts and Science Union of the camp on the following among other subjects:—Conic sections, differential and integral calculus, inorganic and organic chemistry, human physiology, psychology, electro-chemistry, agricultural chemistry, genetics and eugenics, mechanics and hydrostatics, physics, radio-chemistry, technical chemistry, general technology (popular), archæology, photography. The lecturers will be grateful for reference works in these subjects. Dictionaries and scientific periodicals would also be most valuable.

THE war has stimulated research in preventive and curative medicine, and announcements of the discovery of various new remedies and methods of treatment appear from time to time in the public Press. Thus the preparation of a new "polyvalent" serum, presumably made with a mixture of microbes, for the treatment of infected wounds is recorded, and for which extraordinary powers are claimed. The discovery is due to the labours of Profs. Leclainche and Vallée, of the Veterinary College of Alfort. It is also stated that Dr. Bull, of Melbourne, has found in eucalyptus a cure for cerebro-spinal fever. Details of a "new" antiseptic mixture for the treatment of wounds similarly found a place in the daily papers last week. This consists of a mixture of chlorinated lime (bleaching powder), boric acid, and chalk, but, as the *Lancet* points out, the claims to novelty for this antiseptic are ill-founded.

OF all manuals of good advice to the soldier, "Health in the Camp: A Talk to Soldiers," by Col. H. R. Kenwood, is one of the best. It is published by H. K. Lewis and Co., Ltd., London, and it costs threepence. Col. Kenwood, being professor of hygiene and public health in the University of London, and an officer of the Royal Army Medical Corps, writes with authority. Moreover, he writes well, with perfect simplicity, and with some distinction of style; and he takes, as it were for a text, the plain fact that "the obedient and intelligent co-operation of every single soldier is demanded, if the sanitation of the camp is to be what it ought to be." We wish the little book were twice as long as it is. What he says of camp sanitation, and of the vital importance of clean food, pure water, and fresh air, is admirably well said. There is a good short account of the protective treatment against typhoid fever; and there is a very valuable note on the venereal diseases. Of course, sixty small pages are not enough; but he makes every word tell, and seems to have a word or two for every subject of chief interest. He avoids the mistake of throwing a list of names of things at the reader's head; and he does not let diagrams take up room, where every inch is needed for print. In brief, here is an excellent little tract for the soldier, whether in training or at the front.

"PRACTICAL Advice on the Fly Question" has been issued by the Zoological Society of London at the price of one penny. It is apparently an "official" summary of advice based on the inquiries conducted under the society's auspices, and intended to have the authority of the society. The pamphlet is devoted entirely to practical advice on how to deal with flies, how to keep them from food, how to keep them out of the house, how to catch them; it deals with the breeding of flies, the treatment of stable manure and refuse; it ends with a summary of measures recommended for private houses, for the country, for refuse tips, for stable manure, for hospitals, camps, shops, and food factories. Flies are undoubtedly important, both to the nation at large and to the miltary authorities; it is characteristic of this nation that such advice should issue from a private society, rather than from either of the Government departments the business of which this should be. The pamphlet is clearly based upon experience of dealing with flies and upon elaborate investigation on new points; the advice is given in a clear and practical manner. To those who visit the Fly Exhibition, as to all who are interested in the house-fly, this little publication should be of use.

IN the Journal of the Gypsy Lore Society, vol. viii., part i., Mr. A. Russell publishes a useful glossary of Scoto-Romani and Tinklers' Cant. Early collections of this dialect are wanting, and even the interpretation of some words found in Scottish documents of the sixteenth century is doubtful. At an early period the Scottish Romani was amalgamated with that of the Tinklers, a nomad class whose origin is still a puzzle. The most interesting words in the collection are those which have survived in the Scottish-Gypsy dialect, but have been lost in the English. There is also a difference in word forms, which has been explained by the supposition that the majority of English Gypsies of the present day are descended from a later immigration than that of those who left their mark on the Tinklers' Cant of Scotland, though the variation in vowel sounds may be partially due to the influence of local English dialects.

DRS. J. C. COSTERUS and J. J. Smith continue their studies in tropical teratology in the Annals of the Buitenzorg Botanic Gardens, 2e Series, vol. xiv. Several interesting cases of malformations are described and figured, especially in ferns, palms, and orchids. Among the most interesting are two germinating coconuts. In one, three stems are sprouting from a single nut; two stems from a nut have been recorded before, though such cases are not more than one in a thousand, but the present case is one out of forty thousand, and is probably unique. The phenomenon is no doubt due to polyembryony. The other, and more remarkable, case is that of the premature flowering of a germinating coconut. The young plant had produced eleven leaves, the blade of the biggest being 56 cm. long, and a terminal inflorescence bearing both male and female flowers, the latter being at the base, as is normal. Dr. Costerus has previously noticed similar cases of premature flowering in Melia and Tectona (Ann. Jard. Bot. Buitenzorg, vol. ix., p. 115).

THE number, vol. i., No. 8, issued June 22, of the Gardens Bulletin, Straits Settlements, is devoted to a paper on the Para Rubber Trees in the Singapore Botanic Gardens, by the director, Mr. I. H. Burkill. A detailed account of the treatment the trees have received is given, and a very good series of figures illustrate the methods of tapping adopted. The publication of the details of latex-yield will be of great service in determining which trees are the best latex-yielders, and which, therefore, should be used as seed-bearers for the raising of new stock. It is well known that variability is found in the latex-yield of trees in Brazil comparable to that noted in plantation trees. A large map of the rubber ground at Singapore has now been prepared, so that full details of each tree can be accurately noted. A carefully compiled history of the introduction of the Para rubber tree to the Straits, and an account of early tapping records, occupies several pages of this useful paper.

IN an interesting paper entitled "Observations on the Study of Plant Pathology," reprinted from the *Journal of Economic Biology*, June, 1915, vol. x., Nos. 1 and 2, Mr. G. Massee considers generally the subject of plant pathology. He points out that the leading idea in dealing with cultivated plants is to intensify or develop to an abnormal extent either the flowering, fruiting, or some other desirable quality, and in so doing there is a marked tendency to upset the physiological balance of the plant and open the door to the spread of disease. A general discussion of the different types and modes of attack of the various parasitic fungi is followed by some reflections on the training needed by anyone who desires to be a competent plant pathologist, and it is very justly pointed out that a sound knowledge of cultivation and of plant physiology is an essential part of the training. The remark that "the scientific standard of plant pathology, in this country at least, is little above that of spraying to check disease, which is useful in proportion to the benefit derived therefrom," is no doubt partially true, but Mr. Massee appears to forget that a good deal of work is being done in investigating the resistant powers of plants, in the breeding of disease-resistant forms, and in attempting to discover the factors which underlie the susceptibility of plants to disease.

A FURTHER instalment of "Materials for a Flora of the Malayan Peninsula" has just been issued, and is reprinted from the Journal and Proceedings, Asiatic Society of Bengal, vol. lxxv., part iv., 1915. The part before us, No. 25, contains the families Cytinaceæ and Balanophoraceæ, from the pen of Mr. H. N. Ridley, while the Juglandaceæ, Myricaceæ, Casuarinaceæ, Fagaceæ, and Salicaceæ, by Mr. J. S Gamble, occupy sixty-eight out of the seventy-five pages of the instalment. One new species in Balanophoraceæ and eight in Fagaceæ are described. The oaks are particularly interesting, three species of the genus Quercus, a typically northern hemisphere genus, being found in the mountains of Malaya, while there are thirty-five Pasanias and thirteen species of the closely-allied genus Castanopsis. Pasania is a genus confined to Malaya and the Pacific Islands, and the distribution of Castanopsis is remarkable since one species inhabits North America and the rest belong to tropical or subtropical Asia.

THE *Gardeners' Chronicle* for August 14, 1915, contains a well-written article on the Island of Java, dealing especially with the cultivated products, the more important of which are rice, sugar-cane, tobacco, coffee, leguminous crops, and cassava. Good photographs of terraced rice fields in a valley, of the planting of rice in irrigated fields are given. As in the East generally, the agricultural work is mainly done by hand, and mechanical means for carrying out tillage are few. The Dutch are at present engaged in providing a system of education for the natives which the writer of the article considers may prove to be of doubtful value, since it cannot easily be made suitable to local conditions.

PROF. SHIRASAWA describes some new species and varieties of Picea and Abies in the *Gardeners' Chronicle* of August 14. They are *Picea koyamai*, a new species discovered in 1911 on Mount Yatsugatake, in Shinano province, at 1500–2000 m., where it forms a pure stand in the midst of a forest of *Larix leptolepis*. On the same mountain occurs the new variety, *acicularis*, of *Picea bicolor*, Mayr, which has a very limited distribution. Another variety of this species, var. *reflexa*, distinguished by the broad and reflexed apices of the cone scales, is found in the valleys of the Oi and Haya rivers, Central Japan. *Picea maximowiczii*, now a rare spruce, rising to 50 m. in height, was discovered two years ago on the mountain ranges of Shinano province, its native place having been unknown, and a new variety, *olivacea* of *Abies vietchii*—distinguished especially by its olive-grey cone—from the higher mountains of Central Japan, are also described. The account is illustrated by a set of useful figures.

THE *Madras Fisheries Bulletin*, No. 8, 1914, contains two interesting papers by Mr. James Hornell. The first of these is an account of fishery experiments made by an English steam trawler in 1907 for the Ceylon Company of Pearl Fishers, Ltd. The com-

pany has now ceased to exist and the results of the experiments are published. There is very little good trawling ground off the coast of Ceylon on account of the extensive areas of bottom covered by corals, etc. Off Cape Comorin, to the west, south, and east, an area of no less than 4000 square miles within the 100-fathom line was investigated. All of this was good trawling ground. Two tons of fish could be obtained per day's working. The other paper discusses the irregularly cyclic nature of the Ceylon and Indian pearl fisheries. It is well known that there are periods of productive years, two to six in duration. These are followed by periods up to twenty-seven years in duration during which the fishery fails absolutely. The cause of the sterility is the destruction of the growing pearl oysters by predatory fishes. An abundant deposit of oyster spat is soon followed by a great increase in oyster-feeding fish, and after a year or two the latter gain the ascendancy. The grounds then become almost absolutely denuded of oysters. Afterwards they are again planted with spat from irregularly distributed reproducing oysters, it may be at very considerable distances away. The distribution of spat on suitable grounds depends on a number of conditions, and it is relatively seldom that all of these are satisfied at the same time. The barren periods are therefore of much longer duration than the fertile ones. Only by artificial culture of the pearls can a permanent fishery be expected, since it is apparently hopeless to attempt to counteract the destructive action of the predatory fishes.

ORNITHOLOGISTS will be glad to know that, in the *Scottish Naturalist* for August, Mr. John S. Tulloch makes a brief announcement of the fact that the gannet (*Sula bassana*) is extending its breeding range, four nests having been found on the Noup of Noss, Bressay. This record apart, only fifteen breeding stations of this bird are known, and of these nine are British. The only English station, Lundy Island, has of late years been forsaken owing to the merciless persecution to which the birds were subjected. Wales has one station, Grassholme, off Pembrokeshire; Ireland two, the Little Skelling, Co. Kerry, and the Bull, off Co. Cork. Scotland has five stations, all, save the Bass, on the west coast. All these stations, it is to be noted, are islands, the gannet nowhere ever breeding on the mainland.

MR. J. H. GURNEY and Miss E. L. Turner contribute some extremely interesting "Notes on a Long-eared Owl Nesting on the Ground in Norfolk" to the *British Birds Magazine* for August. Inasmuch as there were suitable trees in the neighbourhood, it is curious that the nest should have been made, as it was, in a slight depression on the ground in the middle of a small plantation. Of the five eggs which the nest contained, but three hatched. Miss Turner gives some beautiful photographs of the female brooding her nestlings, which add greatly to the value of this unusual record.

SOME new species of ectoparasitic trematodes are described in the June number of *Zoologica*, a publication issued by the New York Zoological Society. Among these is a quite remarkable new genus represented by two species. One of these, *Atalostrophion sardae*, infests the mucous membrane of the branchial cavity and the thyroid glands of the Bonito (*Sarda sarda*). So far no perfect specimen of an adult worm has yet been secured, nor does it seem likely that this will ever be done. And this because, in the sexually mature state, the body, which is about 6 in. long, and exceedingly fragile, is coiled in tangled masses among the tissues in which it lives, and since broken ends are always found when the specimens are examined *in situ*, it is to be assumed that it is natural for the worm to disseminate its eggs by throwing off the parted sections. Two complete specimens of imperfect worms have, however, been secured, and these have been of the greatest service in determining the details of the anatomy of the adult, of which the largest fragments so far obtained have not exceeded 3 in. in length. The other species was obtained from the gills of a large Jew-fish (*Promicrops guttatus*). This differed from that just described in being more muscular and less delicate. Sufficient material, however, has not yet been secured to enable a full diagnosis of its specific characters to be made.

THE March number of *Terrestrial Magnetism and Atmospheric Electricity* contains a report by Dr. W. F. G. Swann on the atmospheric electrical observations taken during the cruise of the *Carnegie* from Brooklyn to Hammerfest, Spitsbergen, Iceland, Labrador, and home in the summer of 1914. The average value of the vertical potential gradient was 93 volts per metre, with a general increase in the value from summer to winter. The value agrees with the 80 volts per metre found by Simpson and Wright over the South Atlantic in 1910. The electrical conductivity of the air due to both positive and negative ions was $2{\cdot}52\times10^{-4}$ in electrostatic units, and increased to a maximum in September, in agreement with the results found previously for the Atlantic. The average value of the earth-air current was $7{\cdot}7\times10^{-7}$ electrostatic units per sq. cm. The radio-activity was, on the average, 23, in Elster and Geitel units, and corresponds to 12×10^{-12} curies of radium emanation per cubic metre. Some of the decay curves suggest the presence of thorium-B. None of the electrical elements observed showed any marked variations with temperature or fraction of saturation of the atmosphere.

IN his paper on the equations of motion of a plane-kite (Bulletin of the Calcutta Mathematical Society, ii, 1, pp. 25 *et seq.*, now reprinted with additions), Prof. J. M. Bose has broken valuable ground on one of the many unsolved problems of aeronautical rigid dynamics. The assumptions on which the investigation is based lead to cubic equations for symmetric and lateral stability, instead of the biquadratics obtained for the aeroplane. This appears due to the author's assumptions (1) that the kite is a plane surface without dihedral angles or keels, (2) that the line of action of the tension of the string meets the plane of the kite in a fixed point. Mr. C. V. Raman raises valid objections to the second assumption, which certainly does not hold good if the string is forked where it is attached to the kite, as shown in Prof.

Bose's figure. We have made the necessary additions, and find a biquadratic, as was anticipated. But a more unfortunate circumstance is that the author makes the variations in the components of the tension of the kite string depend on the velocity components of the kite instead of on the angular displacements. It is to be mentioned, however, that the investigation is independent of the assumption that the surface of the kite is a narrow plane gliding at a small angle of attack, an assumption sometimes justifiable in the case of an aeroplane, but inapplicable to the old-fashioned quadrilateral kite.

THE *Psychological Bulletin* for June 15 contains several summaries of recent work in the different departments of sense perception. One of them deals with the factors which influence the estimation by an observer using one or both ears of the position of the source of a regular sound such as a musical note. For a person using one ear only Arps and Klemm have confirmed the belief that some factor besides the intensity of the sound heard plays a part in the estimation of the distance of the source. Myers has shown that the timbre of a note is one of the factors which affects the estimation of distance of a source in the hearer's median plane, but not in any other direction. Another summary deals with optical illusions, amongst others with that of two or more parallel lines, one of which when crossed obliquely by short lines no longer seems parallel to the others —Zöllner's lines. Giese has shown that if one line only of a pair of parallel lines is crossed by oblique lines, the extent of the illusion is half that when both lines are crossed when one eye only is used, but that when both eyes are used the illusion is the same in each case. If the figures are presented in succession instead of simultaneously, the extent of the illusion is diminished. Practice also decreases the illusion.

OUR ASTRONOMICAL COLUMN.

AUGUST METEORS.—Mr. Denning writes:—"Very unsettled weather, with thunderstorms unusually prevalent, has interfered with observation of the Perseids this year, but a fair number of them were recorded. The display appears to have been one of average character.

"On August 10 the sky was only partly clear at some places. There were about 20 meteors per hour (14 Perseids) for one observer watching uninterruptedly.

"On August 11 clouds were more abundant, and not much could be seen of the shower.

"On August 12 the sky was very favourable in the west of England, but somewhat clouded in the east. At Bristol 80 meteors (68 Perseids) were seen up to 12.30 p.m., but many others were missed, and the horary rate for a constant watch of the sky would have been about 40.

"On August 13 there were some passing clouds, but up to midnight these did not materially affect the progress of observation. At Bristol 45 meteors (29 Perseids) were counted. The number had evidently decreased since August 12.

"On August 14 several thunderstorms occurred during the night, and nothing could be seen.

"The radiant point of the meteors was as follows:—

July 15	15°+48°
August 10	40°+55°
August 12	47°+58°
August 13	49°+58°

Nearly all the meteors left streaks.

"The most brilliant object appeared on August 13 11h. 8m., shooting from $34\frac{1}{2}^\circ+50^\circ$ to $25\frac{1}{2}^\circ+45\frac{1}{2}^\circ$, where it left a streak for 30 seconds as seen from Bristol. It was seen at Bristol, and by Mrs. Wilson at Harrow. Its radiant point was at 54°+56°, and height 79 to 55 miles, path 48 miles, and velocity 40 miles per second. It moved from over Northampton to Oxford.

"A curious meteor was recorded on August 12 10h. 44m., shooting upwards from $30\frac{1}{2}^\circ+20^\circ$ to $13^\circ+51^\circ$. It moved slowly, and left a bright streak. Half-way along its course it appeared to stop, and then renewed its course.

"The radiant of the Perseid swarm was fully four degrees in diameter.

"Large meteors were not very abundant, but several were noticed, and will be made the subject of further investigation. Several of them were recorded by two or more observers.

"Mrs. Fiammetta Wilson at Harrow-on-the-Hill, and Miss A. Grace Cook at Stowmarket, obtained a number of valuable observations, though the atmospheric conditions were seldom very good. It will be possible to compute the real paths of many large meteors (Perseids) and of several meteors directed from the minor radiants of this period. Mrs. Wilson, with her usual perseverance, has sent the writer a list of 110 meteor-paths observed from August 7 to 15.

"One of the most interesting objects that has appeared during the recent display was a brilliant one from Musca (40°+29°) on August 10 at 9h. 33m. The meteor had a long path of about 154 miles from over London to the English Channel east of Start Point, Devonshire. It fell from a height of 68 to 52 miles.

"A feature noticed in regard to the Perseids was that they exhibited a distinct difference of velocity. This was quite apart from such discordances as might be induced by differences in position and distance. Two meteors appearing in very nearly the same region gave in several instances an apparent speed essentially dissimilar, though presumably at same height, or very nearly so."

THE DETROIT OBSERVATORY.—We have received vol. i., pp. 73–206, of the Publications of the Astronomical Observatory of the University of Michigan, which forms an impressive testimony to the activity of the staff. Thus, in about four years, no fewer than 3200 spectrograms have been secured with the $37\frac{1}{2}$ in. reflector, and meanwhile the Director has found time to organise and direct the work of the La Plata Observatory, which has already made a mark in cometary discovery. The long-projected Lamont 24 in. refractor, it is to be regretted, is still delayed, awaiting the delivery of the flint glass disc from the Jena makers.

The astronomical researches described in the present volume include determinations of the geographical position of the observatory, the visual light curve of β Lyræ, a paper on the characteristics of Cepheid variables, and studies of the spectra of δ and ϵ Orionis, all the work of Prof. Ralph H. Curtiss; the spectra of ψ Persei and β Monocerotis, and radial velocity of Maia, treated by Dr. Paul Merrill; a study of the titanium spark as a comparison spectrum,

by Mr. Lewis L. Mellor; and observations of double stars discovered at the La Plata Observatory (13th Catalogue), by Prof. W. J. Hussey. Numerous observations of comets, including comet Daniel (1909*a*) and of some minor planets, are also published. The preceding part (pp. 1–72) of the volume was noticed in NATURE, vol. xci., p. 67, March, 1913.

OCCULTATION OF β SCORPII BY JUPITER (1876).—The Bulletin of the Astronomical Society of Barcelona (vol. iii., No. 6) contains an article by Senor Vicente Ventosa, of the Madrid Observatory, describing observations he had the good fortune to secure of an unpredicted *occultation* by Jupiter of the brighter component of β Scorpii on February 27, 1876. In the Nautical Almanac for 1876 this conjunction was given as a very close approach with the star, 0° 1′ N. Jupiter was obscured by clouds when the occultation commenced, and when observations were possible β_1 was invisible and emersion was witnessed. This conjunction was referred to in NATURE, vol. xiii., p. 188, and described by Mr. J. Birmingham in the same vol., p. 368. Senor Ventosa, by making use of Coniel's corrections to Bouvard's tables of Jupiter, has calculated the circumstances of the occultation, and from his observations of the variation of magnitude of the star as it left the limb obtains a probable height of 2500–3000 km. for the Jovian atmosphere. An extended account of the research is to be published in the Revista of the Royal Academy of Sciences of Madrid.

THE FIGURE OF THE EARTH.—Many books have been written on this subject, yet the current literature is so comparatively inaccessible to non-specialists, and such meagre statements are generally given in text-books, that there must be many persons ready to welcome the authoritative essay by Prof. W. de Sitter in the August number of *The Observatory*. In directing the attention of our readers to this article, we may add that Prof. de Sitter comes to the conclusion that to improve our knowledge of the figure of the earth we must observe minor planets, and that the opposition of Eros in 1931 will afford the earliest opportunity. It will no doubt be recalled that last year Prof. E. W. Brown, in his opening address to the sub-section of Cosmical Physics of the British Association, stated that direct observations of the moon's parallax are likely to furnish at least as accurate a value of the earth's shape as any other method.

METEOROLOGY OF THE MOON.—An extremely interesting article under this heading appears in *Popular Astronomy* (No. 3, 1915), contributed by Prof. William H. Pickering. It is largely the outcome of some two and a half years' observations, for which the Jamaican station of the Harvard Observatory has evidently proved highly satisfactory. Details are given of changes observed in selected types of lunar surface, elevations, depressions, and level areas. The changes are given as being typical of what is everywhere taking place. A series of drawings of the lunar mountain Pico is reproduced. All the recorded changes are held to fit in with the hypothesis of snow or ice formation, or the reverse. The article successfully makes obvious that our satellite still offers a most fruitful field to zealous and patient work.

R CORONÆ BOREALIS.—This irregular variable is apparently undergoing one of its more or less sudden failures of light. Prof. A. A. Nijland (*Ast. Nach.* 4809, 184) reports that whilst for 2½ years it has been constant at about 6·4m., on July 24, as estimated in opera-glass, its magnitude was 7·1, and on July 29 only 7·6. We find that Prof. Nijland observed secondary minima during the preceding light fluctuations on March 8 and May 13, 1912, the star then fading to 10·2m. and 8·2m. respectively.

THE PRETORIA MEETING OF THE SOUTH AFRICAN ASSOCIATION.

THE South African Association for the Advancement of Science held its thirteenth annual session during the first week of July, at Pretoria, under the presidency of Mr. R. T. A. Innes, Union Astronomer. Notwithstanding the war, festivities and excursions took place as usual, and not the least interesting and instructive of the latter were visits to the Government School of Agriculture at Potchefstroom, to the Bacteriological Research Laboratory at Onderstepoort—said to be the finest institution of its class in the world—and to the 2100 ft. level of the Crown Mines near Johannesburg, which has subterranean galleries extending over an aggregate of 100 miles. It so happened that, on the very day when the news of the surrender of German South-West Africa was received, Mrs. Botha had arranged to visit the association in session at the Transvaal University College; she was accorded a great ovation, after which the members sang the National Anthem.

The papers read numbered nearly eighty, and outlines of some of them, as well as of the four sectional presidential addresses, are given below.

The presidential address given before Section A by Mr. F. E. Kanthack, director of irrigation of the Union, was a historico-scientific account of the development of the internal-combustion engine, the development of which is probably the greatest engineering feat the world has ever seen. This factor in the war is entirely novel, and has had more far-reaching effects than anything else. It is scarcely possible to realise and appreciate the enormous amount of scientific work and inventive genius which has been expended on the motor-car, and especially on the engine. New metallurgical processes had to be invented to produce steels of great strength to survive the shocks and strains of hard-running, and the various machine tools and manufacturing processes connected with motor-car construction are no less wonderful than the finished article. What the steam engine was to the nineteenth century the internal-combustion engine is to the twentieth, and the effect of the latter on society is probably greater and more far-reaching than was the case with the steam engine.

The president of Section B, Mr. H. Kynaston, director of the Union Geological Survey, died during the week preceding the association's meeting, and his address was read by the sectional secretary after a vote of condolence had been adopted. Its theme was "Radio-activity in its Bearing on Geological Problems." The address referred to the significance of the results regarding the concentration of radio-active compounds, although the data are as yet scarcely sufficient for definite conclusions. The view was expressed that either radio-active elements are absent from the more central portion of the earth, or present to an inappreciable extent, or else some agency such as pressure is able to restrain radio-activity in depth, or altogether prevent atomic disintegration. As the latter alternative does not seem to conform to observation, it would appear that radio-active elements are confined to the crustal portion of the globe. The address then went on to discuss the bearing of meteorites on the idea of a radio-active crust, the conclusion being that the evidence certainly lends support to that theory.

Section C also had to meet without its president, Mr. C. P. Lounsbury, chief of the division of ento-

mology of the Union, who, convalescent from an illness which narrowly escaped being fatal, had left South Africa on a six months' tour in Australia and the United States. His address was a discussion of some phases of the locust problem. The author expressed the opinion that the Union is entering upon a cycle of years when locusts will be widespread and destructive. The species of locusts that periodically ravage South Africa were described, the principal being the red and the brown locust, the former being congeneric with the large North African locust and that of the Argentine, while the brown locust is congeneric with the migratory locusts of Europe and Asia. The effects of climatic conditions on locust migration were discussed, as well as the causes of the excessive multiplication. The concluding paragraphs of the address dealt with the enemies of the locust.

In Section D the presidential address was delivered by Mr. J. E. Adamson, Director of Education of the Transvaal; its subject was "The Control of Education," and it laid down the principle that the control of school education should henceforth be vested in the Central Government of the Union and not in the executives of the provinces. It was, he said, a dictate of the national conscience; moreover, national education is a vital factor of national progress, and, in addition, national schools should reflect national aims and aspirations. That there was divergence in South Africa regarding these aims and aspirations was only a further reason for discussing them in a national assembly. Wise and impartial administration would only be secured if it were in the hands of a body representing wide and varied interests.

With regard to the papers read at the various sectional meetings only brief summaries can be given. In Section A Mr. A. H. Reid contributed a useful review of the leading classes of fire-resisting materials used in building construction, while from the naval engineer's point of view Mr. H. C. Kenway discussed certain aspects of modern naval development. The president of the association, in a paper on the masses of visual double stars, gave a table containing all double stars for which fairly trustworthy orbits had been computed. Dr. A. W. Roberts had a paper on secular change in the period of μ Carinæ, the variation of which star was discovered at Lovedale in 1891. The discrimination of the conic by Prof. Dalton, and the gamma, or factorial function, by Prof. Roseveare, were types of the heavier mathematical papers read in the section. Mr. E. Jacot, discussing the measurement of the natural ionisation of the air, contrasted the results obtained by the Gerdien and by the Ebert forms of apparatus, and showed that these results are not comparable.

In Section B Prof. J. A. Wilkinson, in a paper on "The Profession of Pharmacy," urged the need of reform, and pointed to the fact that South Africa as yet offers no pharmaceutical training in any of her colleges, and that materia medica and toxicology are nowhere taught. A paper on the Rand gold, by Prof. E. H. L. Schwarz, discussed the three classical theories as to the origin of the gold, and expressed his preference for the placer theory. Another contribution by the same author had for its subject "The Fault Systems of the South of Africa." Dr. W. A. Caldecott read an important paper entitled "Some Features of the Rand Gold Mining Industry," in which he set forth the main results of the operation of the Witwatersrand gold mines during the past twelve years. Dr. C. F. Juritz, in a paper on the chemical composition of Karroo ash, directed attention to the fact that large quantities of burnt sheep manure had accumulated throughout the Union during many years, and contained up to 19 per cent. of potash, 36 per cent. of lime, and 6 per cent. of phosphorus pentoxide. An interesting paper on the ! Naras plant (*Acanthosicyos horrida*) was contributed by Dr. W. Versfeld and Mr. G. F. Britten, describing the nature of the plant and its edible fruit, which is either consumed as gathered, prepared as soup, or made into cakes. Analyses were given of the fruit and of soils where the plant grows, and where it refuses to grow. Mr. A. Stead contributed a paper on the ash of the "alkali bush," in which he found 32 per cent. of potassium carbonate and 19 per cent. of sodium carbonate.

In Section C Prof. Schönland criticised Lotsy's theory of evolution, which, he declared, has not brought us a step nearer the *vera causa* of evolution. Mr. R. W. Thornton, principal of the Middelburg School of Agriculture, treated of the ostrich feather industry in South Africa, covering briefly, in addition to an historical introduction, the subjects of incubation, rearing, parasitic diseases, and feather marketing. An exhaustive analysis of South African agriculture was submitted in a paper by Mr. P. J. du Toit, Acting-Secretary for Agriculture of the Union, and it showed the marvellous agricultural progress of the country during late years, particularly since 1905. Mr. J. Burtt-Davy contributed a paper on his experiments in cross-breeding Persian and Merino sheep. Of the thirty-six papers submitted to Section C, only two can be adequately summarised here. These are Dr. A. L. Orenstein's paper on prevention of malaria, and Dr. Watkins-Pitchford's on miners' phthisis.

Dr. A. L. Orenstein read before Section C a paper on the problems and principles of malaria prevention, in which he outlined the following five lines of attack:—(1) The elimination of human carriers only; (2) the reduction to a non-infective minimum of the number of anophelinæ of the species capable of transmitting malaria; (3) the protection of the individual against the bites of mosquitoes; (4) the protection of the individual by proper medication against the development of the parasites within the blood; and (5) a combination of several or all of these methods. Of these methods the first is fraught with almost unsurmountable difficulties, the second method being the plan most generally acknowledged to be the most promising of results. Dr. Orenstein described malaria prevention as a highly specialised field of sanitation, and any large-scale scheme as a costly undertaking which should only be entrusted to specialists in this branch.

Dr. Watkins-Pitchford's subject was "Miners' Phthisis on the Rand." He emphasised the not generally recognised distinction between pulmonary silicosis and miners' phthisis. Silicosis due to the inhalation of air containing fine particles of quartz, etc., was rarely fatal; it became the much more serious disease, miners' phthisis, when the damaged lung became infected by the tubercle bacillus. The suppression of the disease would be obtained by action in two directions: preventing the inhalation of dust by workers in the mines, and excluding from the mines all those who were expectorating the tubercle bacillus. The proposition of abolishing miners' phthisis from the Witwatersrand he considered quite feasible, provided always that both the workers and the management co-operated in the common cause.

Dr. C. L. Leipoldt, medical inspector of schools for the Transvaal, in a paper read before Section D, stated that the percentages of men of the burgher commandos of the Transvaal province rejected for preventable and remedial defects were far higher than they were in conscript armies in countries where medical inspection of schools had been in vogue for years. It was clear that a large percentage of the adult population suffered from remedial and preventable diseases, which appreciably affected their wage-earning capacity and consequently the national efficiency. He sug-

gested that school medical inspection should be linked up with the enforced inspection of at least all males between the ages of sixteen and forty-five years by qualified defence force officers.

In Section D one of the most attractive papers was undoubtedly that by Mr. E. C. Reynolds on the economics of the war, for the purpose of hearing which all four sections of the association combined. As at last year's meeting, some of the most interesting papers in this section were those dealing with phases of the native question. Such were two papers by the Rev. Noel Roberts on the initiation rites of the Bapedi, and on the traditional history of the Baganano. The Rev. W. A. Norton had a delightful little paper on African native melodies, all of which, he said, were in the pentatonic scale. The Rev. S. S. Dornan contributed a paper on Rhodesian ruins and native tradition. The author holds that the ruined towns were built by the men whose descendants still live in the country, and at no very distant date. The Rev. J. R. L. Kingon, of the United Free Church Mission at Tsolo, contributed a paper showing that native agriculture is on the threshold of a marvellous expansion, which only awaited the opening up of communications, towards which the Native Council had contributed 28,000*l.* during the last year. Another paper by the same author dealt with the economics of the east coast fever. Proportional representation was the subject of papers by Dr. J. Brown and Mr. R. Kilpin, and "Problems of Physical Continuity" were discussed by the Rev. Dr. S. R. Welch. The Rev. C. Pettman contributed to this section one of his instructive discussions of the origin of South African place-names, in the course of which he reviewed the commonly accepted derivations of such names as Bloemfontein, Algoa Bay, Walfisch Bay, and Slackhers Nek.

Dr. E. T. Mellor gave an evening lecture on the gold-bearing conglomerates of the Witwatersrand, in which he outlined briefly his own theory of the original deposition of the reef conglomerates. This was to the effect that what is now the Witwatersrand was once the deltaic mouth of a river, and that the gravels were deposited here in beds at different times and in slightly different localities. The extent of this delta would be fairly small compared with the extent of the present Ganges delta.

The most interesting function of the session was the award of 50*l.* and the South Africa medal, founded by the British Association in 1905, for scientific research in South Africa, to Mr. C. P. Lounsbury for his entomological investigations. In the absence of Mr. Lounsbury the president, at the conclusion of his inaugural address, enumerated the various pieces of scientific work engaged in by the recipient since he took up his residence in South Africa in 1895, and presented the medal to Dr. C. F. Juritz, to hold in trust until Mr. Lounsbury's return to the country.

TROPICAL DISEASES: STATISTICS AND RESEARCH.[1]

IN reviewing these reports for 1913 we directed attention to the ambiguity involved in the term "Deaths ascribed to fever." Strictly speaking, the term fever should include all disease in which fever is a marked feature, *e.g.* not only malaria, but also enteric, pneumonia, etc., but whether it does so here appears to us to be uncertain. In the Hong-Kong report the heading is changed to "Deaths ascribed to malarial fever," and in the Straits Settlements it is subdivided into "unspecified fever," "malaria," "typhoid," and "dengue." In the returns for Government hospitals the heading does not occur. There surely must be cases in hospital of fever which are not comprised in the four fevers scheduled. If so, they should be returned. Again, under "Estates employing indentured labour" only "deaths ascribed to malaria" are returned. Surely, again, there must be many cases of fever which are not malaria. Why not return these also unless here malaria is synonymous with fever? This ambiguity then continues. A great advance in the statistics of malaria would be made if the diagnosis "fever" were not accepted as the equivalent of malaria. Everyone knows, for example, in India that "thousands" of cases are returned as malaria on no better evidence than the statement of the patient that he is suffering from "fever"; and so one may feel strong doubt as to the figures recorded in this report under the heading, "Attendances for malaria." (Why malaria and not "fever"?)

We repeat what we said last year, that parts of this statistical schedule require careful revision if it is to be of value. To note another statistical point. It cannot be too thoroughly appreciated that accurate population data must form the basis of practically all statistics of disease. Yet in the Mauritius report whereas the number of deaths for certain towns and districts is given, there is most unfortunately no corresponding population given. We might as well be given the number of deaths in India and Ireland and be left to draw our inferences without knowing the respective populations.

Before leaving these matters we would refer to the Southern Rhodesia Report, where a chart of the mortality and distribution of malaria, blackwater fever, and the rainfall for 1913 is given. By itself this is of no great value. Had the data for the ten years 1904–13, which appear to be available, been given, it is probable that definite conclusions could have been drawn.

We would repeat that if these statistics are to be of value in the future more care must be taken in their compilation. It is often said that "statistics lie." We do not believe they do, and that they cannot if only we know exactly what they represent.

Turning next to the appendices we find a variety of matter of much interest and importance. We may briefly mention some of the results.

Kala-Azar.—It has been shown that cultures can be got from the blood, and the use of the method for diagnostic purposes is suggested; it should have been stated whether the case from which cultures were got showed parasites in the blood or not. Coccal bodies have been found in the organs in this disease but their meaning is not clear. Observations in the Sudan do not support the insect transmission theory of the disease. We have ourselves elsewhere suggested the hypothesis that the disease is not transmissible from man, but is acquired by infection with "natural" flagellates of some insect.

Entomology.—Chrysops fixissima of Borneo appears to be a terrible fly. Its bite on the ear gives rise to a swelling like a cauliflower.

A sand-fly larva has been found in soil in the Sudan. Hitherto they were thought to breed almost exclusively in old walls and the like.

A long and interesting paper is devoted to the life-history of *Dermatobia hominis*, the larva of which burrows in the skin of man, producing "warbles." The evidence is detailed in support of the view that certain mosquitoes, Janthinosoma, sp., are used by the œstrid for effecting this. Œstrid eggs have been found cemented to the abdomen of female mosquitoes, as the œstrid appears "to know" that the males do not bite man. When such a female with eggs in position bites, the œstrid larvæ hatch and find their way into the skin. We still require complete proof

[1] Report of the Advisory Committee for the Tropical Diseases Research Fund for the Year 1914. (London: Wyman and Sons, Ltd.)

of this "fairy tale." We require to see an œstrid catch a mosquito and lay its eggs on the abdomen of the latter. We also require (with pocket lens) to see a mosquito with eggs attached biting, and then to see the larvæ emerge and enter the skin. The larvæ when grown and *in situ* are best chloroformed; they can then be fairly easily expressed.

Beri-beri.—A practical demonstration of the view now generally accepted that beri-beri is due to the absence of the subpericarpal layer in polished rice, was afforded by the result of an expedition to the Snow Mountains, in Dutch New Guinea. Previous expeditions had failed except one, of only ten men, and in this *unpolished* rice was used. The expedition here recorded consisted of 204 natives and lasted seven months. There was not a single case of beri-beri. The daily ration in grams was:—Rice, unpolished, 700; fish or meat on alternate days, 150; kachangidju (a bean), 200; Javanese sugar, 50; coffee, 20; tea, 5; salt, occasionally, 20. What is required of rice millers is to produce a "nice-looking" rice with the pericarp removed and the subpericarp retained. Rice millers must accept the facts and not deny that polished rice is a cause of beri-beri, as happened in the writer's experience recently. A rice containing not less than 0·4 per cent. of phosphorus pentoxide is a safe one, but inspection or other simple tests is quite enough to tell a safe from an unsafe rice. "Parboiled" rice is also safe, but many natives will not eat it, as it does not look nice and has an objectionable smell.

Leprosy.—The successful cultivation of the bacillus has been claimed by various observers, but in the experiments detailed in this report all attempts were negative, although the "successful methods of other observers were followed." The subject is at present in a state of hopeless confusion.

Bilharzia.—It has been shown by Japanese workers that the Japanese form of this disease was contracted (by dogs) by immersion in water. It was thought that this proved the direct penetration of the skin by the miracidia that hatched from the egg, but Leiper and Atkinson have shown that it is the Cercariæ which have passed through a mollusc that are the infective stage.

The appendices give evidence of the enthusiasm with which research is followed, but we think there might be some co-ordinating system linking together researches in various colonies.

RECENT ENTOMOLOGICAL RESEARCH.

NO English-speaking zoologist is likely to have overlooked the exhaustive work on the life-cycle of *Trypanosoma lewisi*, recently published in the *Quart. Journ. Microsc. Sci.* (vol. lx., part 4), by Prof. A. E. Minchin and Mr. J. D. Thomson. This great research involved the dissection of 1700 rat-fleas (*Ceratophyllus fasciatus*), and Prof. Minchin gives, in the last number of the Journal of the Quekett Microscopical Club (2, vol. xii., No. 76), as a kind of by-product, some details of the anatomy of the insect. The nervous system, reproductive organs, and salivary glands receive special attention. In the nervous system there is a curious sexual dimorphism, the male having eight distinct abdominal ganglia, while the female possesses only seven. The salivary glands of the larva are much larger than those of the adult, and the larval duct is provided with a reservoir, wanting in the corresponding imaginal structure; these differences are correlated with the well-known difference in the nature of the food, the flea being a blood-sucker, while the larva devours solid particles—commonly the excreta of the rat. Students of insect anatomy will be grateful to Prof. Minchin for his detailed account of his simple and successful methods of manipulation.

The woolly aphid of the apple, commonly known as "American blight," has been the subject of many interesting observations recently; for example, we have had Mr. J. Davidson's careful anatomical research into the different forms of the species (*Quart. Journ. Micr. Sci.*, vol. lviii., 1913, part 4), and Miss E. M. Patch's demonstration that the elm is the normal host-plant for the wingless sexual stage of the species and for the early spring generations (Maine Agric. Exp. Sta. Bull., 203, 217, 220, 1912–13). Now Mr. A. C. Baker has published (U.S. Dept. Agric., Report 101, 1915) a comprehensive account of the structure, life-history, and economic importance of the insect in a pamphlet of fifty-six pages, illustrated by fifteen excellent plates. He believes that the generic name Eriosoma (Leach, 1820) must supersede Schizoneura (Hartig, 1841), which has been universally used in recent years. As regards the life-cycle, he confirms the latest conclusions of Miss Patch that *E. ulmi* is identical with the currant-root feeding *fodiens*, while *E. lanigera* (the "American blight") is an altogether different species, with the elm as its normal "principal" host, and the apple, hawthorn, and rowan as alternative summer hosts. As a matter of fact, the virgin females of *lanigera* are commonly found on the bark or roots of apple-trees throughout the winter months, so that the sexual phase may be tending to disappear from the life-history altogether. It is interesting—after so many American writers have objected to the identification of their continent as the original home of this "blight," and have contended for its European origin—to find it here considered that the weight of evidence indicates the insect as a native of the "New World."

A similar doubt as to the country of its origin exists with regard to another orchard insect-pest, the pear thrips (Euthrips, or *Taeniothrips pyri*), which since 1900 has caused much damage both in the eastern and western United States, and in some English localities. A complete account of its life-history and habits in California, by Messrs. S. W. Foster and P. R. Jones, has just been published (U.S. Dept. Agric. Bull. 173). The adults feed in the blossom-buds, and the larvæ on the fruits, not of the pear only, but of other rosaceous trees; while pupation takes place in the soil, the transformation being completed about midwinter, though the winged thrips do not appear until some months later. In California all the adult individuals are believed to be parthenogenetic females, although males have been found in this country by Mr. R. S. Bagnall.

Dr. A. D. Hopkins continues his excellent systematic studies of the bark-beetles, with a "Classification of the Cryphalinæ" (U.S. Dept. Agric., Report 99), in which some new genera and a large number of new species are described, the latter not being all North American. This is the fourth "Contribution towards a Monograph of the Scolytoid Beetles," the second having appeared in the Proc. U.S. Nat. Mus., vol. xlviii., and the first and third as No. 17 of the Technical Bulletins of the U.S.D.A. Bureau of Entomology. This disconnected mode of publication—somewhat troublesome to the bibliographer—is due to the discontinuance of the special series of bulletins hitherto issued by the Bureau of Entomology, the results of the work of which will apparently henceforth be mingled with those emanating from other sections of the Department of Agriculture. From this centralisation there may perhaps be some benefit derivable that is not apparent to an ordinary entomologist, who cannot fail to appreciate its inconvenience. Report 107 of the U.S. Department of Agriculture consists of a short but valuable and beautifully illustrated paper on the larvæ of long-horn beetles of the division

Prioninæ, by F. C. Craighead. In the *Journ. Agric. Research* (vol. iv., No. 3) W. S. Pierce describes weevils of the genus Diaprepes, which injure sugar-cane in the West Indies, and gives details as to their variation and life-history.

The gipsy moth (*Porthetria dispar*) imported from France into Massachusetts in 1869 continues to occupy the attention of American entomologists; Mr. A. F. Burgess describes the means adopted in the New England States for checking its ravages (Bull. U.S. Dept. Agric., 204). His account is illustrated by an interesting set of maps showing the present range of the species in New England, and also of some of its natural enemies which have been imported from Europe, of which the large ground-beetle, *Calosoma sycophanta*, is the most formidable. Reference is also made to the strange "wilt-disease" which at times fortunately becomes epidemic among the caterpillars. It has been made the subject of a special research by Mr. R. W. Glaser (*Journ. Agric. Research*, vol. iv., No. 2). He finds that the disease was not present in North America before 1900, and believes that its spread may be at least partly due to some of the introduced parasites. The causative micro-organism has not been demonstrated.

The cabbage-fly (*Phorbia* or *Chortophila brassicae*) is one of our commonest and most destructive garden pests. Mr. J. T. Wadsworth has published (*Journ. Econ. Biol.*, vol. x., No. 1) a valuable and interesting account of a rove-beetle, *Aleochara bilineata*, the larva of which eats its way into the puparium of the cabbage-fly, and feeds on the pupa. Like some other beetle life-histories, this shows a tendency to hypermetamorphosis, the newly-hatched Aleochara being of the campodeiform type normal to the family, while the later instars, in accordance with their parasitic habit, have shortened legs and swollen bodies, approaching the cruciform type.

A contribution to our knowledge of the physiology of aquatic insects is due to Mr. S. K. Sen, who gives some observations on the respiration of Culicidæ (*Indian Journ. Med. Research*, vol. ii., No. 3). The larva of *Culex microannulatus* consumes 1·1 cubic mm. of oxygen per hour, the pupa 1·9 cubic mm., and the imago 2·5 c.c.; the increased oxygen-hunger of the pupa as compared with the larva is noteworthy, and it was found that the pupa is more quickly affected and killed by the want of oxygen. Systematic study of blood-sucking Diptera goes steadily on; the British species of Simulium are diagnosed by Mr. F. W. Edwards in the last number of the *Bulletin of Entom. Research* (vol. vi., part 1). This same number contains a report by Dr. W. A. Lamborn on the "control" of tsetse-flies (Glossina) in Nyasaland; a number of flies were caught by bird-lime spread on boards carried about by native boys, and digging-wasps are found to seize tsetses and carry them off. Hymenopterous parasites of the Chalcidoid group have been reared from Glossina puparia in northern Rhodesia, and these are described with excellent figures by Rev. Jas. Waterston, in the same number of the bulletin.

Of slight importance from the economic point of view, the Odonata (dragonflies) are yet of great general interest to the student of insects. Mr. E. B. Williamson has just published (Proc. U.S. Nat. Mus., vol. xlviii., pp. 601–38) some exceptionally valuable notes on Neo-tropical species belonging to the "demoiselle" (Agrionine) subfamily. The purely systematic entomological paper is usually a weariness to any not a specialist who may attempt to read it, but this author enlivens his accounts of structural details of diagnostic value with descriptions of the habits and adaptations of the beautiful insects which he loves to observe when alive in the swamps and forests of Central America and the Antilles. G. H. C.

THE NATURAL HISTORY OF CORUNDUM.[1]

IN the Summary report of the Geological Survey of Canada for 1896 Mr. W. F. Ferrier directed attention to the occurrence of corundum crystals in the township of Carlow, Hastings County, Ontario, and to the probable economic importance of the discovery. This announcement led to the opening up of what has become the largest corundum mining industry in the world. In 1910 an important memoir by Adams and Barlow on the general geology of the district in which the corundum-deposits occur was published by the Geological Survey (Geology of the Haliburton and Bancroft Areas, Memoir No. 6), but the details as to these deposits were reserved for fuller treatment than was possible at that time. They are now given in the present volume, together with a general account of the occurrences of the mineral in other parts of the world.

Apart altogether from their economic importance, the Canadian deposits are of considerable scientific interest as throwing light on one of the methods by which corundum has been naturally produced. They are usually associated with nepheline and other alkaline syenites which occur at the junction of the great Laurentian granitic batholiths with the limestones of the Grenville series. Red alkaline syenites, rich in soda, together with their coarse-grained pegmatitic equivalents, are pre-eminently the corundum-bearing rocks throughout the district, although in one of the smaller areas the mineral occurs in anorthosites. The richest rock is known as corundum-pegmatite, dykes of which may attain a width of 18 ft. and contain as much as 75 per cent. of corundum. Individual crystals weighing 30 lbs. have been obtained from this rock. In other rocks they are smaller in size, and often sink to microscopic dimensions. The colour usually varies from blue to white. No transparent varieties suitable for use as gems have as yet been found.

In his classic researches carried out in Warsaw during the years 1891–96 and published in *Tschermak's Mineralogische und petrographische Mittheilungen* for 1898, Morozewicz proved that felspathic magmas, especially those rich in soda, possessed the power of dissolving alumina, and that on cooling the excess of alumina over that required to form felspar crystallised out as corundum. The facts described in this memoir clearly prove that the Canadian corundum has crystallised out of a highly felspathic magma in accordance with the principles experimentally established by Morozewicz. The mineral is extracted from the rocks by blasting, hand-picking, crushing, and dressing by methods akin to those frequently used by miners. From material fed to the mills containing 10½ per cent. of corundum a high-grade product consisting of from 90 to 95 per cent. is obtained. It is at present employed solely as an abrasive agent, although researches have been, and are still being, carried out to discover other uses. The value of the total amount placed on the market to the end of 1913 is about 2,000,000 dollars, and there has been no appreciable falling off in the amount produced during recent years. Its principal rivals are carborundum and artificial corundum, known as alundum, both of which are produced at Niagara Falls.

ANCIENT ARABIC METEOROLOGY.[2]

AT what stage of intellectual development, premonitory signs of weather were first connected with coincident, but probably unrelated, phenomena,

[1] "Corundum: Its Occurrence, Distribution, Exploitation and Uses." By Alfred Ernest Barlow, Department of Mines, Canada. Pp. 377+28 plates and a geological map of Central Ontario.

[2] "Some Arabic Weather Sayings." By Mohammad Bey Kasim. Reprinted from the *Cairo Scientific Journal*, Nos. 97 and 98. (Alexandria, 1914.)

and expressed in popular phrases is doubtful, but in every part of the world may be found a stock of proverbs that express the general experience. Egypt, of course, is no exception to the rule, and, owing to its old civilisation, it is probable that in these wise saws we have the fruits of the earliest meteorological observations. We cordially welcome, therefore, the paper by Mohammad Bey Kasim, who by industriously collecting a long list of these predictions, and translating them into English, has benefited both meteorology and folklore.

In a climate where the changes are frequent and apparently lawless, these are apt to be assigned to frivolous and irrational causes, but in more settled climates, as that of the Nile Valley, the prognostications may be regarded as founded on a more scientific basis. Weather changes are seasonal, rather than daily, and as the Coptic year is based on solar reckoning, the repetition of the same phenomena at nearly the same dates in successive years would tend to confirm the accuracy of the proverb, and give rise to a running commentary on the calendar, useful in the guidance of husbandry and agricultural operations.

Thus in the month Abib (July 8–August 6) we have in its translated form the saying:

In Abib, it will be found
We hear the running water's sound.

referring to the expected rise of the Nile, and, in the following month, Misra:

Misra makes all the watercourses flow,
Though difficulties it must undergo.

That the proverb-mongers were quite aware of the necessity of making provision for the variability of seasons, and not limiting the changes too rigidly to the arbitrary divisions of months, is shown by an ingenious interlocking of Amshir and Baramhat, which together include the spring from February 8–April 8, when periods of warm and cool weather will interchange:

The month of Amshir to Baramhat says:
Exchange ten of mine for ten of your days.

The author does, however, give a complete calendar, in which apparently an attempt is made to foretell the weather from day to day, but it is not clear whether this is a perpetual calendar, or liable to revision from year to year according to the fancy of the local expert. For comparison additional information founded on average meteorological data is supplied. The main climatological factors are sufficiently well indicated. Thus for 22 Tut (October 2) the comment is, "No hope of more rises of the Nile." The Cairo observations show that that date is the mean, and not the extreme of maximum flood, for which the variation is ±16 days. The fixing of the low stage of the Nile to 27–28 Bashans (May 4–5) is not so happy. The mean date from 1873 has been about a month later, but since the Aswan Reservoir has been utilised a comparison of dates may be misleading. The fact that is emphasised by this calendar is the advantage due to employing the apparent motions of the sun, as shown by the assistance given to the old meteorologists in the maintenance of a continuous record.

Another feature of this admirable compilation is the successful attempt to classify the terms used in Egypt to describe the degrees of variation in the climatological elements. The Egyptian vocabulary seems to be wide and rich; seven terms are given expressing gradations of "cold," and a round dozen for different degrees of heat. Naturally there must be a good deal of overlapping, and the phrase, "the hot weather (el harr) lasts seven days or three," may be capable of very wide interpretation. Apparently the author has been very successful in accommodating the terms expressing varying strength of winds to our Beaufort scale, and the accuracy in the two cases is no doubt comparable, since each depends on eye observation and memory. The forms of clouds, too, have long been described with sufficient accuracy, and Luke Howard, who has supplied our nomenclature, has but followed an unknown, but ancient, classification. We are glad to know that Mohammad Bey proposes to continue his investigations into a subject that cannot but grow more interesting the further it is pursued.

COMPETITIONS IN CONNECTION WITH THE UTILISATION AND DENATURING OF SPIRIT OR ALCOHOL FOR INDUSTRIAL PURPOSES.

THE following particulars have been received by the Board of Trade, through the Foreign Office, from the Russian Ambassador in London, respecting the international competitions organised by the Russian Ministry of Finance in respect (1) of methods of utilising spirit or alcohol or their products, and (2) of new substances for denaturing spirit or alcohol for industrial purposes.

As regards the first-mentioned competition, prizes of 60,000, 30,000, and 10,000 roubles, respectively, will be awarded for the invention of a novel means of adapting alcohol for the preparation of such a product as shall by its nature absolutely differ from the spirit from which it is made, *e.g.* vinegar, ether, chloroform, etc. Three prizes, of 50,000, 20,000, and 5000 roubles, respectively, will be awarded for the invention of a novel method of utilising spirit for the preparation of a product (*e.g.* a pharmaceutical or perfumery preparation) of which spirit or its products (sulphuric ether, etc.) will appear as one of its component parts or dissolvent, providing that spirit cannot be extracted profitably from the product. Three prizes of 30,000, 15,000, and 5000 roubles, respectively, will be awarded for the invention of a novel method of utilising spirit in productions, where spirit or its products would serve as temporary intermediary dissolvents of either of the extracted or precipitated materials, *e.g.* in the manufacture of smokeless powder, artificial silk, etc. Further prizes ranging from 75,000 to 5000 roubles will be awarded for the invention or perfection of apparatus for the utilisation of spirit as motive power, fuel, or illuminant.

The competition of new substances for denaturing spirit or alcohol is being organised with the object of extending the use of spirit for technical purposes, and accordingly three prizes of 30,000, 15,000, and 5000 roubles, respectively, are offered for finding novel denaturing materials for improving the existing methods of denaturing, which, whilst guaranteeing the free use of denatured spirit, would obviate any possibility of using it as a beverage.

Applications in respect of both these competitions should be addressed to "L'Administration générale des Impôts indirects et du Monopole de l'Alcool," Tutchkoff Naberezhnaia, Petrograd, not later than January 11–14, 1916, and must be accompanied by samples. Such applications should be made in the Russian or French languages, and be enclosed in a special envelope bearing an inscription or device of some sort, the name and address of the applicant being submitted under separate cover bearing the same inscription or mark.

Inventors may reserve the right of benefiting by their inventions and of protecting themselves with letters patent.

Copies of the full text of the conditions for participating in the two competitions above referred to may be obtained by United Kingdom firms interested, on application to the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

GRANTS FOR SCIENTIFIC INVESTIGATION AND UNIVERSITY WORK.

WHEN the Government scheme for the promotion of scientific and industrial research was announced in the House of Commons in May last, it was stated that, to begin with, a sum of 25,000*l.* would be placed at the disposal of the advisory council appointed in connection with the scheme. This sum, and any other amounts voted by Parliament for the same purpose, will be included in the Civil Service Estimates under the Grants in Aid of Scientific Investigation. All the grants made under this head for 1915–16, together with grants from the Development Fund, and to universities and university colleges, are shown in the subjoined statement from the ninth annual report of the British Science Guild. The provision which is now being made for research gives topical interest to the facts here brought together.

GRANTS FOR SCIENTIFIC INVESTIGATION.

The annual grants made by Parliament specifically for scientific investigations and related services amount to about 100,000*l.*, and the details of the estimates for 1915–16 are shown in the subjoined table.

	£
Royal Society :—	
(i) (*a*) Scientific Investigations ...	4,000
(*b*) Scientific Publications	1,000
(ii) Magnetic Observatory at Eskdalemuir	1,000
(iii) National Physical Laboratory ...	7,000
(iv) Aeronautical Section of the National Physical Laboratory	9,425
Meteorological Office	22,500
Royal Geographical Society	1,250
Royal Academy of Music	500
Royal College of Music	500
Marine Biological Association of the United Kingdom	500
Royal Society of Edinburgh	600
Scottish Meteorological Society	100
Royal Irish Academy	1,600
Royal Irish Academy of Music	300
Royal Zoological Society of Ireland ...	500
Royal Hibernian Academy	300
British School at Athens	500
British School at Rome	500
Royal Scottish Geographical Society ...	200
National Library of Wales	8,200
National Museum of Wales	17,300
Solar Physics Observatory	3,000
British Academy	400
School of Oriental Studies	1,500
North Sea Fisheries Investigation ...	1,250
Imperial Transantarctic Expedition, 1914–15	5,000
Edinburgh Observatory	1,657
	£90,582

The grants to the National Physical Laboratory and the Meteorological Office, amounting altogether to nearly 40,000*l.*, are for direct national services rather than scientific investigation; and when these amounts are deducted the actual sums voted by the State to scientific institutions, or for purposes of research, show little relationship to those which the trustees of the Carnegie Institution of Washington are able to give. The institution was founded by Mr. Carnegie in 1902, with an endowment of 2,000,000*l.*, to which he added 400,000*l.* in 1907, and a further 2,000,000*l.* in 1911. The articles of incorporation of the institution declare "that the objects of the corporation shall be to encourage, in the broadest and most liberal manner, investigation, research, and discovery, and the application of knowledge to the improvement of mankind." The grants made by the trustees amount to nearly a quarter of a million pounds annually.

In addition, however, to the specific State grants under the foregoing head of scientific investigation, much larger funds are at the disposal of the National Health Insurance Joint Committee and the Development Commissioners.

Under the National Health Insurance Act the annual revenue accruing from one penny in respect of each insured person (payable out of moneys provided by Parliament) provide a fund from which grants are available for the purposes of medical research. The total amount available annually for this purpose is about 56,000*l.*

GRANTS FROM THE DEVELOPMENT FUND.

The Report of the Development Commissioners for the year ended March 31, 1914, describes the work of the Commission during the year 1913–14. Attention is directed to three cardinal facts relating to the provisions of the Acts constituting the Development Fund and Commission. First, the amount hitherto appropriated by Parliament to the Fund is 2,900,000*l.*; secondly, the Commissioners are a purely deliberative and advisory body, having no power themselves to carry out schemes of which they approve; thirdly, grants and loans from the Fund can only be made for certain specified purposes (speaking generally for the development of the agriculture and fisheries of the United Kingdom and for connected purposes such as forestry and the construction and improvement of canals and harbours) and to certain specified bodies, which do not include companies trading for a profit.

The expenditure actually recommended by the Commissioners, under the head of Agricultural and Rural Industries, during the year 1913–14 was 472,793*l.* (practically all grants), as compared with 227,600*l.* during 1912–13. This large increase is due partly to the fact that during 1913–14 three or four large grants were recommended for capital expenditure on buildings, and for some years' working of a scheme which could not be started on the basis of annual grants; such advances as 28,650*l.* for a veterinary laboratory for the Board of Agriculture and Fisheries, 18,000*l.* for buildings for the Edinburgh and East of Scotland College of Agriculture, 28,675*l.* for a ten years' scheme of tobacco experiments in Ireland, 10,325*l.* for buildings at Reading University College, 10,000*l.* for buildings at the Midland Agricultural and Dairy College, are not annual requirements. The grant to the Board of Agriculture and Fisheries in aid of agricultural research and experiments during 1914–15 was 46,900*l.*, and for the Farm Institutes scheme 58,350*l.* Under the head of forestry the advances recommended by the Commissioners amounted to 91,100*l.*, and the grants actually made amounted to 34,500*l.*, of which 6500*l.* was for forestry research and advisory work during 1913–4 and 8100*l.* for the same purposes in 1914–15. The total grants made in connection with fisheries were 20,900*l.*, of which 11,100*l.* was for fishery research and 2000*l.* a supplementary grant for a fishery research vessel.

The Report concludes with the following statement of the position of the Development Fund and Commission :—

The total amount guaranteed to the Fund for the period up to the end of the financial year 1914–15 was 2,900,000*l.*, the whole of which sum has been paid over to the Fund.

Up to March 31, 1914, the Commissioners had actually recommended advances up to the amount of 1,493,375*l.*, of which 1,216,695*l.* were grants and 276,680*l.* loans. The main reason for the excess of grants over loans is the large expenditure on education and research—purposes which for obvious reasons are scarcely suitable subjects for loans. Of this sum,

perhaps 220,000*l.* may be deemed to have lapsed, owing to such causes as the failure of applicants to expend the whole advance sanctioned during the period for which it was advanced. It would appear that if the amount of the Development Fund is 2,900,000*l.*, and effective advances to the amount only of 1,280,000*l.* were sanctioned up to March 31, 1914, the sum of 1,620,000*l.* still remains unappropriated. This is, however, not the case; the Commissioners having been compelled to commit themselves in substance to expenditure much in excess of the advances actually recommended.

The expenditure incurred or sanctioned for the period up to March 31, 1916, in connection with agriculture and rural industries, forestry and afforestation, and fisheries is as follows:—

(1) *Agriculture and Rural Industries.*—This purpose has absorbed a considerably larger proportion of the Fund than any other object. The expenditure hitherto sanctioned is 921,549*l.*, of which perhaps 200,000*l.* has lapsed. During 1914–15 and 1915–16 some 400,000*l.* more may be required, mainly for the following objects—the continuance of the schemes of research, technical advice, and instruction in agriculture already set on foot throughout the United Kingdom; buildings and farms for agricultural colleges; further provision for research in veterinary science; the continuance of the existing schemes for the improvement of cattle, light horse and other live stock breeding, and the promotion of co-operation. It would certainly not be safe to place the total demands for these purposes at less than 1,100,000*l.*

(2) *Forestry and Afforestation.*—The total amount recommended hitherto for this purpose is 142,749*l.*, of which rather more than 80,000*l.* has been advanced by way of loan. But large demands must be anticipated during the next two years, as several schemes which have taken some time to mature are now, it is hoped, approaching completion. These include a Scotch demonstration area, the acquisition of one or more experimental areas in England and Wales, afforestation schemes for land already purchased in Ireland, and loans to local authorities for the afforestation of water catchment areas. The Commissioners reserve, conjecturally, another 200,000*l.* for these purposes up to 1916—making the total expenditure 350,000*l.*

(3) *Fisheries.*—65,557*l.* has been advanced for this purpose; but a large scheme of research is now being considered. 150,000*l.* is provisionally taken as the total expenditure, but this estimate is even more conjectural than the others given.

The total sums for all purposes is 2,250,000*l.*

The net result is that the Commissioners estimate that on March 31, 1916, the amount actually spent from the Development Fund will not be less than 2,000,000*l.*; it may be 200,000*l.* or 300,000*l.* more. After that date an annual sum of approximately 275,000*l.* will be required to keep in operation schemes already sanctioned for such purposes as agricultural research, forestry, and fisheries research, and agricultural education, which ought to be continued permanently or at least for some years.

GRANTS FOR UNIVERSITY EDUCATION.

The universities and university colleges in Great Britain which are in receipt of grants from the Board of Education are as follows:—The Universities of Birmingham, Bristol, Durham (Armstrong College), Leeds, Liverpool, Manchester, Sheffield, London (including University College, King's College, Bedford College, School of Economics, and East London College), the University Colleges of Nottingham, Reading, and Southampton; the University of Wales (University Colleges of Aberystwyth, Bangor, and Cardiff).

The subjoined table shows the sources of income of these institutions:—

Incomes of Universities and University Colleges.

	(1) ENGLAND. Amount. £	Per cent. of total	(2) WALES. Amount. £	Per cent. of total
Fees	183,880	27·8	17,456	27·7
Endowments	95,045	14·4	4,448	7·1
Donations and subscriptions	22,381	3·4	2,330	3·7
Annual grants from local authorities	103,650	15·7	3,441	5·5
Parliamentary grants (see below)	233,000	35·2	34,220	54·3
Contributions from hospitals, etc., for services rendered	2,338	0·4		
Other income	20,486	3·1	1,132	1·7
	660,780		63,027	

Grand Total, £723,807.

The income from endowments of universities and university colleges in England and Wales in receipt of State grants is about 100,000*l.*, which is also the amount of the annual income of the Carnegie Trust for the universities of Scotland. About half this amount is devoted annually to the payment of students' fees, and the other moiety is voted as grants for (1) the better equipment of the Scottish universities and colleges by the foundation of additional chairs and lectureships and by the provision of new laboratories and permanent equipment, and (2) the encouragement of research. A writer in NATURE of May 14, 1914, in an article upon the twelfth annual report of the trust, says:—"The impetus to research which has been produced by the work of the trust can be gauged from an example chosen from one science, chemistry. In the eight years 1903–11, the trust appointed in this department forty-five scholars, twenty-five fellows, and thirty-one grantees. The work of these has resulted in the publication of more than 130 original communications to scientific journals. Now, in 1912, the contributions of the whole British chemical world to the Transactions of the Chemical Society amounted to only double this number, 266, so that it is evident that the Carnegie Trust, by its encouragement of research, has indirectly in the course of eight years produced a series of results equal to half the annual output of the whole Empire at the present time. This, it must be remembered, represents only a single department of the trust's activities; for, in addition to chemistry, work is being carried out in physics, biology, medicine, economics, history, and languages."

The Parliamentary grants to universities and university colleges (1912–13) included in the foregoing table are made up of contributions under various heads as shown below:—

	ENGLAND		WALES
Exchequer	170,000	...	25,500
Board of Education: Technological and other Professional Work	22,600	...	430
Board of Education: Training of Teachers ...	22,400	...	4,990
Board of Education: Other Grants	8,500	...	230
Other Government Departments	9,500	...	3,070
Total	£233,000	...	34,220

The grants for technological and other professional work, amounting to about 23,000*l.*, are part of a total sum of nearly 45,000*l.* allocated under this head in 1913–14. Twenty-four institutions in all receive State aid in this way, ten of them being also in receipt of the Exchequer grants to universities and colleges.

In Germany, State subsidies provide the main part of the incomes of the universities. The annual ex-

penditure for the universities from State funds amounts in round figures to 1,800,000*l.* In 1913 the expenditure of the University of Berlin alone was 242,000*l.*, and of this amount 200,000*l.*, or about 83 per cent., was derived from State funds.

The estimates for the year ending March 31, 1916, show the following grants for universities and colleges in the United Kingdom:—

Great Britain.	£
University of London	8,000
Victoria University of Manchester	2,000
University of Birmingham ...	2,000
University of Wales	4,000
University of Liverpool	2,000
Leeds University	2,000
Sheffield University	2,000
Bristol University	2,000
Durham University	2,000
Scottish Universities	84,000
Colleges, Great Britain	150,000
University Colleges, Wales ...	12,000
Welsh University and Colleges: Additional Grant	15,000
Total	£287,000

Ireland.	£
A.—Grants for the General Purposes of the	
Queen's University of Belfast	18,000
University College, Dublin ...	32,000
University College, Cork ...	20,000
University College, Galway ...	12,000
B.—Grants in respect of the Cost of Purchasing Lands and Providing or Improving the Necessary Buildings and Equipment for the—	
National University of Ireland and University College, Dublin	40,000
University College, Galway (185o*l.* revote)	—
C.—Additional Grant in augmentation of sums amounting to 150*l.* or more contributed from local sources in 1914–15 towards increasing the Resources of University College, Galway ...	2,000
Total	£124,000
Imperial College of Science and Technology	30,000
Royal College of Science, Dublin ...	17,000
University Institutions in respect of Technological Work	59,000
Grand total	£517,000

Certain of the universities, colleges, and other similar institutions which are in receipt of Parliamentary grants have been adversely affected by the war, more especially by the loss of fee income arising from the widespread response among men students to the call for recruits. The estimates for 1915–16 include, therefore, a special grant of 145,000*l.* in aid of such universities, colleges, medical schools, and agricultural institutions, to meet loss of income arising during the war.

Benefactions.

The benefactions to higher education in the United States during the forty years from 1873 to 1913 amounted to nearly 100,000,000*l.*, and are still increasing at the rate of about 5,000,000*l.* annually.

The report of the United States Bureau of Education for the year ending June 30, 1913, shows that during the year the total sum received in gifts and bequests by universities and other institutions of higher education, excluding grants by the United States, different States, and municipalities, was 4,930,390*l.* Of this amount 895,320*l.* was for increase of plant, 825,980*l.* for current expenses, and 3,209,100*l.* for endowment. Forty-five institutions reported gifts of more than 20,000*l.*

The income of the 596 institutions of higher education from which the Bureau receives reports was during the year, from State and municipal grants, 3,809,960*l.*; from invested funds, 3,313,960*l.*; and from fees for tuition and other educational services, 4,183,830*l.*

Summary.

The Carnegie Institution of Washington has an endowment fund of 4,400,000*l.*, and makes grants of nearly 200,000*l.* annually for purely scientific investigations and publications.

The Parliamentary grants in aid of scientific investigation, including the services of the Meteorological Office and the National Physical Laboratory, amount to about 100,000*l.* annually, or 125,000*l.* including the new grant recently made.

The grants for the purposes of medical research, under the National Health Insurance Act, amount to about 56,000*l.* annually.

The total amount appropriated by Parliament to the Development Fund is 2,900,000*l.*; and it is estimated that up to the end of March, 1916, the expenditure will be on agriculture and rural industries 1,100,000*l.*, on forestry and afforestation 350,000*l.*, and on fisheries 150,000*l.*

The Parliamentary grants for universities and colleges in the United Kingdom amount to about half a million annually; the State grants to universities in Germany reach nearly two millions annually.

The benefactions to institutions of higher education in the United States amount to about five millions annually; in the United Kingdom the average is less than one-tenth this sum.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

London.—The following science appointments have been made by the council of Bedford College for Women:—Assistant-lecturer in philosophy, W. A. Pickard-Cambridge; assistant-lecturer in physics, Miss M. O. Saltmarsh; demonstrator in physics, Miss M. Baxter; demonstrators in physiology, Miss Hartwell and Miss Tweedy; demonstrator in geology, Miss I. Lowe.

Oxford.—Captain C. F. Balleine, fellow and subrector of Exeter College, who was killed in action on July 2 (a note on whom appeared on p. 543 of our issue for July 15), bequeathed 1000*l.* to the rector and scholars of Exeter College, to be employed in some way for the benefit of that college as the governing body may direct.

The foundation stone of the new Welsh National School of Medicine at Cardiff was laid on Thursday last by Lord Pontypridd.

A laboratory for the investigation of occupational diseases is to be established in Pittsburgh, under the supervision of Dr. J. W. Schereschewsky, of Washington.

A proposal is on foot to endow the library of the department of mathematics of Brown University in honour of Prof. N. F. Davis, who, after upwards of forty years' service, is shortly to retire.

The sum of 8500 dollars has been given by Miss E. Cuyler and Mr. T. De Witt Cuyler to the George

Peabody College for Teachers for the equipment of the Jesup psychology laboratory of the institution.

THE sum of 1,145 dollars has been given to the University of California for the carrying out of the survey of the animal and bird life of the Yosemite National Park, by the California Museum of Vertebrate Zoology.

DR. F. BILLINGS, of Chicago, is announced to deliver the next course of Lane medical lectures at the School of Medicine of Stanford University. He will take as his subject, "Focal Infection," and the course will extend from September 20 to 25 next.

WE notice the following appointments in connection with American colleges:—Prof. H. S. Jackson, of the Oregon Agricultural College, to be head of the botany department of the Purdue University Agricultural Experiment Station, in succession to Dr. J. C. Arthur; Dr. E. W. Sinnott, of the Bussey Institution, to the chair of botany and genetics at the Connecticut Agricultural College.

TROOP COLLEGE OF TECHNOLOGY, Pasadena, has recently received from an anonymous donor the sum of 10,000 dollars towards the equipment of a research laboratory in physical chemistry, and the promise of a like amount yearly for the maintenance of the laboratory. Dr. A. A. Noyes is to be in charge of the new department, dividing his time between Troop College and the Massachusetts Institute of Technology.

ACCORDING to the Bulletin of the John Rylands Library, Manchester, the appeal on behalf of the University of Louvain which was made by the bulletin has met with a very encouraging reception, upwards of 3000 volumes having already been received or promised. We are glad to learn that an international committee is in process of formation, with the view to co-ordinate the many efforts that are being employed in this country, and also on the Continent, to assist in bringing about the restoration of the devastated library.

THE calendar for the year 1915 of the National University of Ireland is now available. Among the changes in the courses and in the regulations for the year 1916 of which notice is given may be mentioned those in connection with the matriculation examination, travelling studentships, and the courses for higher degrees. For the purposes of matriculation the University is prepared to accept the certificates of a number of examining boards in the British Isles and Australia, and the matriculation certificates of ten specified universities. In addition, any person who has matriculated in any university of the British Dominions and Colonies, other than those already referred to, and has also passed an Intermediate examination in arts or science in that university, will be exempted from the matriculation examination of the National University of London.

SIR A. H. CHURCH, who died on May 31, left to the Royal Society his reversionary interest in forty-three 20*l.* shares in the London County and Westminster Bank (Limited) with the request that when it falls into possession the income may be applied for purposes connected with the preservation or utilisation of the archives of the Royal Society; 500*l.* to the rector and fellows of Lincoln College, Oxford; to the Waynflete professor of mineralogy in the University of Oxford 100*l.* for the purchase of apparatus and mineral specimens, together with the testator's microscope and other optical instruments and mineral specimens, and his chemical apparatus; and 100*l.* to the curators of the Ashmolean Museum. He further requested his wife to make, among others, the following gifts in her lifetime or bequests at her death:—To the trustees of the British Museum for the mineralogical gallery in the Natural History Museum, his collection of cut precious stones, or such thereof as the keeper of the minerals may select; to the curators of the Ashmolean Museum, Oxford, his collection of Japanese sword guards, and of sliders or beads, and of Chinese and Japanese bronzes, several Indian glass sprinklers, and a number of other curios and antiques.

THE Berne correspondent of the *Morning Post*, quoting from the *Akademische Rundschau*, gives some interesting information respecting the effects of the war upon the German universities, technical schools, and colleges. It is stated that in the summer term of 1914 there were, at the twenty-two German universities, eleven technical academies, five commercial schools, three veterinary schools, and six agricultural and mining schools, 79,077 students entered, a number which in the autumn of 1914 had sunk to 64,710. Of this number the following were under arms:—

University students	36,000
Technical students	8,000
Commercial students	6,000
Veterinary students	300
Agricultural students	300
Mining students	300
Total	50,900

The following are the *percentages* of students of some of the universities who have gone to the front:—Königsberg, 84; Heidelberg, 60; Munich, 56; Berlin, 54; Frankfurt, 11. Of the technical academies Danzig sent the highest proportion of students—90 per cent. The total number of German professors and students killed in the war, up to the end of May, is said to be 1191; Leipzig University has suffered most severely, losing 266 of its students.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 2.—M. Ed. Perrier in the chair.—G. **Bigourdan**: The letters of L. Euler in the correspondence of J. N. Deslisle. H. **Douvillé**: The Orbitoids of Trinity Island. The distribution of these foraminifera is utilised for the classification of the Eocene strata at Trinity Island.—W. **Kilian** and Antonin **Lanquine**: The tectonic complications of the south-eastern portion of the Basses-Alpes, near Castellane.—A. **Leduc**: The internal pressure of gases. The influence of temperature. Experimental data for sulphur dioxide at temperatures between 0° and 1000° C. are not in good accord with the formulæ of Clausius and Sarrau. A new expression is proposed which presents the experimental results with greater exactness.—Sabra **Stefanescu**: The origin of some accidents of the crown of elephants' molars.—Louis **Gentil**: The analogies of the Moroccan Haut Atlas and Atlas of the Sahara.—R. **Chudeau**: Temperature in western and equatorial Africa.—V. **Wallich**: The suppression of suppuration in war wounds. The treatment, the very favourable results of which are described, is based on suppressing all causes of irritation at the level of the wound, together with the use of a stringently aseptic dressing. No antiseptics are used, draining tubes are removed as early as possible, and the compresses are moistened with a solution of common salt (one tablespoonful to the litre of water) sterilised by boiling for fifteen minutes before use.—V. **Galippe**: Parasitism in seeds and its importance in general biology. Experiments carried out on thirty-one species of plants showed that normal seeds can contain parasites. In ninety series of experiments seventy-eight results were positive. The parasite was usually a fungus, more rarely a yeast. The possibility of these parasites causing sudden mutations in plants is discussed.—

Edmond **Perrier**: Remarks on the preceding paper.—Armand **Gautier**: Remarks on the same note of V. Galippe.

August 9.—M. Ed. Perrier in the chair.—J. Comas **Solà**: Stereoscopic photography in the study of the proper motions of stars. The method is based on the extreme delicacy of the eyes, which are capable of producing sensations of relief by displacements of the order of 1 μ to 2 μ, even making use of an ordinary stereoscope. Placing in a stereoscope two corresponding images of regions near star cluster M. 11, one taken July 12, 1912, and the other July 20, 1915, numerous stars show in relief. In a surface of 20° square, no fewer than 200 stars give evidence of movement after three years.—Thadée **Banachiewicz**: The method of Olbers and multiple solutions.—Arnaud **Denjoy**: The four fundamental cases of derived numbers.—J. **Vallot**: Correction for the error introduced by the containing vessel in the determination of the diathermic power of liquids. The usual method of correcting for the effects of the containing walls is erroneous, owing to reflections due to the different refractive indices of glass and liquid. A slight modification of the usual measurements eliminates this error. Albert **Gascard** and Emile **Belgnot-Devalmont**: The localisation of projectiles by radiography.—F. **Bodroux**: A method of preparation of hydrocarbons of the formula $(C_6H_5)_2CH.R$, R being an aromatic nucleus. Phenylmagnesium bromide and bromodiphenylmethane react readily in ether solutions giving triphenylmethane. Paratolyldiphenylmethane and α-naphthyldiphenylmethane can be prepared with good yields by a similar reaction.—E. **Léger**: The resolution of β-nataloin and β-homonataloin into their optical isomerides.—I. **Pouget**: The use of aluminium in preventing deposits in boilers. It is well known that laboratory water baths provided with arrangements for keeping a constant level, when fed with hard waters are put out of action through the feed tube becoming choked with scale. The author has used a water-bath, painted inside with aluminium paint, for three years, nearly continuously, without stoppage, and gives the results of experiments showing that the presence of aluminium greatly diminishes scale formation.—MM. **Russo** and **Tussau**: Geological expeditions through central Morocco.—Emile **Belot**: The deficit and excess of the acceleration of gravity on continents and islands with respect to the isostatic condition of the earth's crust.—Henry **Hubert**: The climates of western Africa.—F. **Garrigou**: Waters containing chlorides and iodides, bromides, sulphides and metals at Beaucens (Hautes-Pyrénées).—Mme. A. **Laborde**: The action of radium on vicious scars resulting from war wounds. The radium radiation was used after filtration through 0·5 mm. of platinum, and from the results of the cases described the conclusion is drawn that the radium treatment may be recommended to set free nerves or tendons included in cicatricial tissue, without any danger of forming fresh adhesions.—M. **Marage**: Contribution to the study of deafness resulting from war wounds. The deafness results from lesions of the auditive centres, either new or of a kind very rarely observed. These lesions are due either to direct shocks on the cranium or to a sudden displacement of air.—Henry D. **Dakin**: Certain antiseptic substances containing chlorine suitable for the treatment of wounds. In studying the germicidal power of antiseptics, it is necessary to take into account the effect of the presence of serum and proteid material in modifying the action. An antiseptic should be soluble, not precipitable by proteids, and possess a minimum toxic power and local irritating action. Hypochlorites fulfil some of these conditions, but are irritating and inconstant in composition. These two drawbacks can be overcome by using a solution of sodium hypochlorite prepared in a manner detailed. The sodium salts of benzene and toluene sulphochloroamides can also be advantageously used as antiseptics. Their aqueous solutions can be used under higher concentrations than hypochlorites, and are very slightly toxic.—R. **Anthony**: A brain of a fœtus of the gorilla.—Edmond **Bordage**: Histolytic phenomena observed during the regeneration of the appendices in certain Orthoptera.

BOOKS RECEIVED.

Elements of Finite Differences, also Solutions to Questions Set for Part I. of the Examinations of the Institute of Actuaries. By J. Burn and E. H. Brown. Second edition. Pp. 289. (London: C. and E. Layton.) 10*s.* 6*d.*

Mededeelingen van de Rijksopsporing van Delfstoffen. No. 6: The Pliocene Floras of the Dutch-Prussian Border. By Clement Reid and Eleanor M. Reid. Pp. 178+plates xx. (The Hague: The Institute for the Geological Exploration of the Netherlands.)

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